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Title: **JP2003007662A2: SUBSTRATE-CLEANING APPARATUS**

Derwent Title: Substrate washing apparatus in manufacture of semiconductor device, includes pair of washing units comprising substrate retention mechanism and drive mechanism, arranged vertically ([Derwent Record](#))

Country: JP Japan

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Assignee: EBARA CORP

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IPC-7: [B25J 9/06](#); [B65G 49/07](#); [H01L 21/304](#); [H01L 21/68](#);

Priority Number: 2001-06-21 JP2001000187940

Abstract:

PROBLEM TO BE SOLVED: To provide a small installation space substrate-cleaning apparatus, capable of being made small sized with easy maintenance of replacement, cleaning, and the like of its component and the like.

SOLUTION: An upper stage cleaning unit 10 and a lower stage cleaning unit 50 are arranged in the upper and lower two stages, the upper stage cleaning unit 10 comprises a substrate-holding mechanism 11 and a driving mechanism 12, the lower stage cleaning unit 50 comprises a substrate-holding mechanism 52 and a driving mechanism 53, and the upper stage cleaning unit 10 can be flipped upward via a hinge 51.

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PATENT ABSTRACTS OF JAPAN

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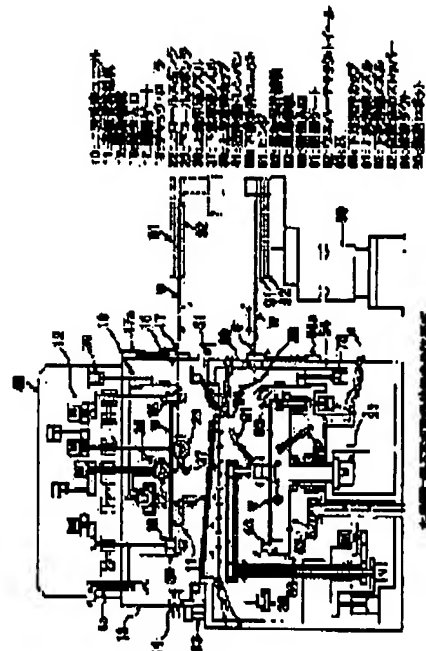
(72)Inventor : ISHIKAWA SEIJI

(54) SUBSTRATE-CLEANING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a small installation space substrate-cleaning apparatus, capable of being made small sized with easy maintenance of replacement, cleaning, and the like of its component and the like.

SOLUTION: An upper stage cleaning unit 10 and a lower stage cleaning unit 50 are arranged in the upper and lower two stages, the upper stage cleaning unit 10 comprises a substrate-holding mechanism 11 and a driving mechanism 12, the lower stage cleaning unit 50 comprises a substrate-holding mechanism 52 and a driving mechanism 53, and the upper stage cleaning unit 10 can be flipped upward via a hinge 51.



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CLAIMS**[Claim(s)]**

[Claim 1] The substrate washing station characterized by having arranged the washing unit possessing the drive which drives the substrate maintenance device and this substrate maintenance device which a substrate is held to two steps of upper and lower sides.

[Claim 2] The substrate washing station characterized by being the washing unit which enforces the washing approach by which said upper case washing unit differed from the lower-berth washing unit mutually in a substrate washing station according to claim 1.

[Claim 3] It is the substrate washing station characterized by for said upper case washing unit having arranged said drive more nearly up than said substrate maintenance device, and said lower-berth washing unit having arranged said drive caudad from said substrate maintenance device in a substrate washing station according to claim 1.

[Claim 4] The substrate washing station characterized by carrying in to the washing unit of another side with said carrier robot if a carrier robot is provided, a substrate is carried in to one washing unit of said vertical stage washing units with this carrier robot and washing termination is carried out in a substrate washing station according to claim 1.

[Claim 5] The substrate washing station characterized by to be roll/roll scrubber washing unit to which either of said vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively in a substrate washing station according to claim 2, and to be pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with said drive.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the substrate washing station which washes substrates, such as a semi-conductor wafer, through the washing process from which plurality differs.

[0002]

[Description of the Prior Art] With improvement in the degree of integration of a semiconductor device, a high air cleanliness class is required also of washing of a substrate, and it is washed through the washing process from which plurality differs. The conventional substrate washing station arranges separately the washing unit which carries out a different washing process to a horizontal plane, conveys a substrate between washing units using a carrier robot, washes it through washing by these two or more washing units, and is drying the substrate after washing termination.

[0003] As mentioned above, it has the problem of needing a large installation tooth space while equipment enlarges it, since the conventional washing station arranges two or more washing units to the horizontal plane. Moreover, the problem that became large and a carrier robot's business area became large also had the migration length of the carrier robot which conveys a substrate. Moreover, since two or more washing units are arranged horizontally, when depth becomes large and maintains exchange, washing, etc. of components etc., it cannot access from one side face, but there is a problem that it must access from two or more side faces.

[0004] As mentioned above, when for example, floor line cost installs a washing station in an expensive clean room, since the problem that a large installation tooth space must be needed or the maintenance of exchange, washing, etc. of components etc. must be accessed from two or more side faces needs a big tooth space, it is inconvenient.

[0005]

[Problem(s) to be Solved by the Invention] It aims at this invention having been made in view of the above-mentioned point, being able to remove the above-mentioned problem, and being able to miniaturize it, and installation area being small, and ending and the maintenance of exchange, washing, etc. of components etc. offering an easy substrate washing station.

[0006]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the substrate washing station characterized by having arranged the washing unit possessing the drive which drives the substrate maintenance device and this substrate maintenance device which a substrate is held to two steps of upper and lower sides has invention according to claim 1.

[0007] Since the washing unit has been arranged to two steps of upper and lower sides as mentioned above, while being able to miniaturize the whole equipment, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0008] Moreover, invention according to claim 2 is characterized by being the washing unit which enforces the washing approach by which the upper case washing unit differed from the lower-berth washing unit mutually in a substrate washing station according to claim 1.

[0009] As mentioned above, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station

constituted small can wash a substrate through a different washing process.

[0010] Moreover, in a substrate washing station according to claim 2, it is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by being pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with said drive.

[0011] Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0012] With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing is carried out, and spin desiccation can be carried out after this pencil scrub washing is completed.

[0013] Moreover, it is characterized by for the upper case washing unit having arranged the drive in a substrate washing station according to claim 1 more nearly up than a substrate maintenance device in invention according to claim 3, and the lower-berth washing unit having arranged the drive caudad from the substrate maintenance device.

[0014] When the upper case washing unit has arranged the drive as mentioned above more nearly up than a substrate maintenance device and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance device of vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0015] In a substrate washing station according to claim 1, invention according to claim 4 will be characterized by carrying in to the washing unit of another side with a carrier robot, if a carrier robot is provided, a substrate is carried in to one washing unit of the vertical stage washing units with this carrier robot and washing termination is carried out.

[0016] Since it will carry in to the washing unit of another side with a carrier robot if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot as mentioned above, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0017] Moreover, in a substrate washing station according to claim 1, it is characterized by providing the ***** device which has been over up about the upper case washing unit.

[0018] By providing a ***** device as mentioned above, the maintenance of the parts replacement of the washing unit of a vertical stage, washing, etc. becomes easy in the condition of having bounded up, about an upper case washing unit.

[0019] Moreover, in a substrate washing station according to claim 2, invention according to claim 5 is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by to be pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with a drive.

[0020] Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0021] With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

[0022]

[Embodiment of the Invention] Hereafter, the example of a gestalt of operation of this invention is explained based on a drawing. Drawing 1 thru/or drawing 4 are drawings showing the configuration of the substrate washing station concerning this invention, and drawing 1 is drawing in which in the whole substrate washing station configuration and drawing 2 the upper case washing unit configuration of a substrate washing station and drawing 3 show the lower-berth washing unit configuration of a substrate

washing station, and drawing 4 shows a carrier robot's configuration, respectively. This substrate washing station has arranged the upper case washing unit 10 and the lower-berth washing unit 50 up and down, the penetrant remover drain pan 41 has been arranged in the middle, and the batch has separated the upper case washing unit 10 and the lower-berth washing unit 50 so that it may illustrate. Moreover, it can have bounded up and the upper case washing unit 10 can be rotated now, as shown in drawing 5 through a hinge 51. The upper case washing unit 10 is positioned by the positioning stopper 83 attached in the casing 54 of the lower-berth washing unit 50, when it lowered and takes down through a hinge 51.

[0023] The upper case washing unit 10 possesses the drive 12 which drives the substrate maintenance device 11 and this substrate maintenance device 11 which Substrate W is held. The part except the drive 12 of the upper case washing unit 10 is covered by casing 13, an inlet 14 and a jet pipe 15 are formed in this casing 13, and the taking-out inlet port 16 which performs the taking-out close of Substrate W further is formed. Moreover, the gate 17 opened and closed by cylinder 17a is established in the taking-out inlet port 16. Moreover, a drive 12 is carried on casing 13 and covered by casing 40.

[0024] As shown in drawing 6, the substrate maintenance device 11 possesses Chuck Laura [two or more (drawing four pieces)] 18 arranged at equal intervals at the periphery section of Substrate W, and this chuck roller 18 fixes to the lower limit of a spindle 19, respectively, and it rotates each spindle 19 by the motor 20 of a drive 12. Moreover, each spindle 19 can be moved now in the direction of a path of Substrate W in a cylinder 21, and pinches Substrate W by actuation of this cylinder 21 in two or more Chuck Laura 18, and by rotation of a motor 20, Substrate W rotates it, as shown in an arrow head A. In addition, drawing 6 is the B-B sectional view of drawing 2.

[0025] 22 and 23 are the upper roll sponge which becomes with the roll mold washing fixture which washes both sides of the upper and lower sides of Substrate W, and bottom roll sponge, respectively. The bevel gear 26 which mesh with the bevel gear 25 which fixed to the lower limit of a spindle 24 in the edge of upper roll sponge 22 fix, and by rotation of a motor 27, as shown in an arrow head D, it rotates. Moreover, the bevel gear 30 which mesh with the bevel gear 29 which fixed also at the lower limit of a spindle 28 or edge of bottom roll sponge 23 fix, and by rotation of a motor 31, as shown in an arrow head E, it rotates.

[0026] Moreover, a spindle 24 can be moved now in the vertical direction in a cylinder 33 in the direction of a path of Substrate W in a cylinder 32, and, thereby, can move upper roll sponge 22 in the direction of a path and the vertical direction of Substrate W. Similarly, a spindle 28 can be moved now in the vertical direction in a cylinder 34 in the direction of a path of Substrate W in a cylinder (not shown), and, thereby, can move bottom roll sponge 23 in the direction of a path and the vertical direction of Substrate W. 35 is a cleaning tub for carrying out self-cleaning of the upper roll sponge 22. Moreover, although illustration is omitted, the cleaning tub for carrying out self-cleaning of the bottom roll sponge 23 is also prepared.

[0027] 36 is an upper penetrant remover nozzle for injecting a penetrant remover on the top face of Substrate W, and 37 is a bottom penetrant remover nozzle for injecting a penetrant remover on the inferior surface of tongue of Substrate W. The periphery of the substrate maintenance device 11 is surrounded with the upper case process cup 38, and this upper case process cup 38 can move up and down now in a cylinder 39.

[0028] The lower-berth washing unit 50 possesses the drive 53 which drives the substrate maintenance device 52 and this substrate maintenance device 52 which Substrate W is held. As for the lower-berth washing unit 50, the whole is covered by casing 54. The inlet 55 and the exhaust port 56 are established in this casing 54. The downflow air jet hole duct 57 arranged in the upper part of casing 54 on the inferior surface of tongue of the penetrant remover drain pan 41 is open for free passage to this inlet 55, and is opening the jet pipe 58 for free passage for the exhaust port 56. Moreover, the taking-out inlet port 60 which performs the taking-out close of Substrate W is established in casing 54, and the gate 61 opened and closed by cylinder 61a is established in this taking-out inlet port 60.

[0029] The substrate maintenance device 52 possesses the wafer chuck wheel 62 which has the pawl [two or more (drawing four pieces)] 63 in the periphery section, as shown in drawing 7. A pawl 63 consists of fixed pawl 63b and movable pawl 63a, fixed pawl 63b is fixed to the periphery section top face of the wafer chuck wheel 62, and movable pawl 63a is supported by this fixed pawl 63b free [rotation] by shaft 63c. This movable pawl 63a rotates to hard flow (direction which opens a pawl 63) by ****(ing) the end of rod 63a, being energized by the one direction (direction which closes a pawl 63) focusing on shaft 63c by spring 63d resiliency, and always operating the pawl driving cylinder 64. That is,

the periphery section of Substrate W is pinched by fixed pawl 63b and movable pawl 63a by operating the pawl driving cylinder 64, laying Substrate W on fixed pawl 63b, where a pawl 63 is opened (condition of having rotated movable pawl 63a focusing on shaft 63c), and making the pawl driving cylinder 64 non-operative. In addition, drawing 7 is the F-F view Fig. of drawing 3.

[0030] The wafer chuck wheel 62 is rotated by the motor 65. This motor 65 and the pawl driving cylinder 64 constitute the drive 53 which drives the substrate maintenance device 52. Moreover, the wafer chuck wheel 62 is surrounded with the lower-berth process cup 66 arranged at the periphery, and this lower-berth process cup 66 can move up and down now in a cylinder 78. The washing drain pan 67 is arranged under the wafer chuck wheel 62.

[0031] 68 is the pencil sponge used as the pencil mold washing fixture which washes upper both sides of Substrate W, and this pencil sponge 68 is connected with a motor 86 through a spindle 69, a pulley 70, a belt 71, a pulley 72, and a spindle 73, and as rotation of this motor 86 shows to an arrow head G, it rotates. The pulley 70, the belt 71, the pulley 72, and the spindle 73 are held in the washing arm 74. This washing arm 74 is connected with a motor 75 through a belt 77 and a pulley 76, and as shown in the arrow head H of drawing 7, it can be circled now in it. Moreover, the washing arm 74 can move up and down now in a cylinder 79.

[0032] 80 is a cleaning tub for carrying out self-cleaning of the pencil sponge 68. 81 is an upper penetrant remover nozzle which injects a penetrant remover on the top face of the substrate W held at the substrate maintenance device 52, and 82 is a bottom penetrant remover nozzle which injects a penetrant remover on the inferior surface of tongue of this substrate W. 90 is a carrier robot which adjoined the substrate washing station and has been stationed, and as shown in drawing 4, this carrier robot 90 has the hand, the upper hand 91 and the bottom hand 92, of two, moves both the hands 91 and 92 in the vertical direction, makes it circle, he makes a level radial expand and contract and can position each hand 91 and 92 now.

[0033] In the substrate washing station of the above-mentioned configuration, the air 101 inhaled from the inlet 14 of the upper case washing unit 10 is exhausted through a jet pipe 15. Moreover, the air 102 inhaled from the inlet 55 of the lower-berth washing unit 50 serves as a downflow, flows out of nozzle opening 57a of the downflow air jet hole duct 57, and is discharged from a jet pipe 58. Moreover, in the upper case washing unit 10, the penetrant remover 103 used for substrate washing flows down to the penetrant remover drain pan 41, and is discharged through the effluent duct 84. Moreover, in the lower-berth washing unit 50, the penetrant remover 104 used for substrate washing flows down to the penetrant remover drain pan 67, and is discharged through the effluent duct 85.

[0034] On the occasion of washing of Substrate W, Substrate W is first received from the last process of washing by the hand 92 under a carrier robot 90. next, the gate 17 of the upper case washing unit 10 is gone up by actuation of cylinder 17a -- making (it opening) -- a process cup 38 is raised by actuation of a cylinder 39. Next, a carrier robot 90 inserts the bottom hand 92 from the taking-out inlet port 16, and the substrate W to hold retreats delivery and this upper hand 92 to Chuck Laura 18 of the substrate maintenance device 11. in this condition, the gate 17 is descended by actuation of cylinder 17a -- making (it closing) -- a process cup is dropped by actuation of a cylinder 39. The substrate maintenance device 11 in which this held Substrate W will be in the condition of having surrounded the perimeter with the upper case process cup 38, and a penetrant remover will cease to disperse. Pinching Substrate W by actuation of a cylinder 21 as mentioned above in two or more Chuck Laura 18, Substrate W rotates by rotation of a motor 20.

[0035] Injecting a penetrant remover to the vertical side of Substrate W from the upper penetrant remover nozzle 36 and the bottom penetrant remover nozzle 37, contact the top face of Substrate W in upper roll sponge 22, contact the inferior surface of tongue of Substrate W in bottom roll sponge 23, respectively, it is made to rotate, and the vertical side of Substrate W is washed. After washing termination raises the upper case process cup 38 while raising the gate 17. A carrier robot 90 inserts the bottom hand 92 in the interior from the taking-out inlet port 16, does reception retreat of the substrate W after washing termination, and descends to the location of the taking-out inlet port 60 of the lower-berth washing unit 50. next, the gate 61 is descended by actuation of cylinder 61a -- making (it opening) -- the lower-berth process cup 66 is dropped by actuation of a cylinder 78, the bottom hand 92 is inserted from the taking-out inlet port 60, and the substrate W to hold is passed to the substrate maintenance device 52 of the lower-berth washing unit 50. Then, the upper hand 91 retreats, goes up

and performs [Substrate W] delivery and washing for Substrate W to Chuck Laura 18 of the substrate maintenance device 11 of the upper case washing unit 10 by the receipt and the same actuation as the above from the last process of washing.

[0036] After the substrate maintenance device 52 of the lower-berth washing unit 50 receives the substrate W after washing termination in the upper case washing unit 10, it pinches the periphery section of Substrate W by fixed pawl 63b and movable pawl 63a of a pawl 63, and holds Substrate W. Then, the gate 61 is raised while raising the lower-berth process cup 66 (it closes). The substrate maintenance device 52 in which this held Substrate W will be in the condition of having been surrounded by the lower-berth process cup 66 grade, and a penetrant remover will cease to disperse. A motor 65 is started in this condition and Substrate W is rotated in a low-speed field (for example, below 200rpm extent). While injecting a penetrant remover to the vertical side of the substrate W held by the substrate maintenance device 52 from the upper penetrant remover nozzle 81 and the bottom penetrant remover nozzle 82, the top face of Substrate W is contacted rotating pencil sponge 68, and Substrate W is washed.

[0037] A motor 86 performs rotation of pencil sponge 68, and the contact to a substrate W top face is performed by dropping the washing arm 74 in a cylinder 79. Moreover, pencil sponge 68 will circle by making it circle in the washing arm 74 by the motor 75, rotating the top face of Substrate W. Pencil sponge 68 passes through the center of rotation of Substrate W, rocks it to the outer edge of Substrate W, and washes Substrate W. Supersonic vibration is given by the ultrasonic energy grant means which is not illustrated to pencil sponge 68 the very thing or a penetrant remover at this time, a cleaning effect may be raised or the cleaning effect by cavitation destructive operation may be raised with a means to make a penetrant remover cause cavitation. And after washing termination makes it circle in the washing arm 74 to the outside of Substrate W, inserts pencil sponge 68 into the cleaning tub 80, and carries out self-cleaning. moreover, after washing termination of Substrate W carries out high-speed rotation (for example, 1,000rpm - 4,000rpm) of the substrate W by the motor 65, and disperses the penetrant remover adhering to a front face with a centrifugal force -- making -- desiccation -- being the so-called -- spin desiccation is carried out.

[0038] after spin desiccation termination drops the gate 61 -- the lower-berth process cup 66 is both dropped. In this condition, a carrier robot's 90 upper hand 91 is inserted into the lower-berth washing unit 50 from the taking-out inlet port 60, from the substrate maintenance device 52, it is made to retreat and that substrate W to hold is contained to a receipt and the cassette which does not illustrate this substrate W. After retreat of the upper hand 91 raises the lower-berth process cup 66 while raising the gate 61. Of course, while raising the gate 61 like the above after carrying in Substrate W by the bottom hand 92 when carrying in the substrate W which washing ended in the upper case washing unit 10 continuously, the lower-berth process cup 66 is raised and washing and spin desiccation are performed.

[0039] In addition, although the upper case washing unit 10 was made into roll/roll scrubber washing unit possessing two roll mold washing implements in the above-mentioned example and having carried out as the substrate washing station considering the lower-berth washing unit 50 as pencil scrub washing and a spin-dry unit possessing a pencil mold washing implement, both the substrate washing stations that apply to this invention may constitute the upper case washing unit 10 and a lower-berth washing unit 50 at roll/roll scrubber washing unit, as shown in drawing 8.

[0040]

[Effect of the Invention] As mentioned above, as explained, according to invention given in each claim, the effectiveness which was excellent as follows is acquired.

[0041] Since the washing unit has been arranged to two steps of upper and lower sides, while being able to miniaturize the whole equipment according to invention according to claim 1, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0042] According to invention according to claim 2, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station constituted small can wash a substrate through a different washing process.

[0043] When the upper case washing unit has arranged the drive more nearly up than a substrate maintenance device according to invention according to claim 3 and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance

device or vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0044] Since according to invention according to claim 4 it will carry in to the washing unit of another side with a carrier robot if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0045] According to invention according to claim 5, with the substrate washing station constituted small by making one side of a vertical stage washing unit into roll/roll scrubber washing unit, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the substrate washing station which washes substrates, such as a semi-conductor wafer, through the washing process from which plurality differs,

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PRIOR ART

[Description of the Prior Art] With improvement in the degree of integration of a semiconductor device, a high air cleanliness class is required also of washing of a substrate, and it is washed through the washing process from which plurality differs. The conventional substrate washing station arranges separately the washing unit which carries out a different washing process to a horizontal plane, conveys a substrate between washing units using a carrier robot, washes it through washing by these two or more washing units, and is drying the substrate after washing termination.

[0003] As mentioned above, it has the problem of needing a large installation tooth space while equipment enlarges it, since the conventional washing station arranges two or more washing units to the horizontal plane. Moreover, the problem that became large and a carrier robot's business area became large also had the migration length of the carrier robot which conveys a substrate. Moreover, since two or more washing units are arranged horizontally, when depth becomes large and maintains exchange, washing, etc. of components etc., it cannot access from one side face, but there is a problem that it must access from two or more side faces.

[0004] As mentioned above, when for example, floor line cost installs a washing station in an expensive clean room, since the problem that a large installation tooth space must be needed or the maintenance of exchange, washing, etc. of components etc. must be accessed from two or more side faces needs a big tooth space, it is inconvenient.

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, as explained, according to invention given in each claim, the effectiveness which was excellent as follows is acquired.

[0041] Since the washing unit has been arranged to two steps of upper and lower sides, while being able to miniaturize the whole equipment according to invention according to claim 1, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0042] According to invention according to claim 2, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station constituted small can wash a substrate through a different washing process.

[0043] When the upper case washing unit has arranged the drive more nearly up than a substrate maintenance device according to invention according to claim 3 and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance device of vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0044] Since according to invention according to claim 4 it will carry in to the washing unit of another side with a carrier robot if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0045] According to invention according to claim 5, with the substrate washing station constituted small by making one side of a vertical stage washing unit into roll/roll scrubber washing unit, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] It aims at this invention having been made in view of the above-mentioned point, being able to remove the above-mentioned problem, and being able to miniaturize it, and installation area being small, and ending and the maintenance of exchange, washing, etc. of components etc. offering an easy substrate washing station.

[Translation done.]

*** NOTICES ***

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MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the substrate washing station characterized by having arranged the washing unit possessing the drive which drives the substrate maintenance device and this substrate maintenance device which a substrate is held to two steps of upper and lower sides has invention according to claim 1.

[0007] Since the washing unit has been arranged to two steps of upper and lower sides as mentioned above, while being able to miniaturize the whole equipment, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0008] Moreover, invention according to claim 2 is characterized by being the washing unit which enforces the washing approach by which the upper case washing unit differed from the lower-berth washing unit mutually in a substrate washing station according to claim 1.

[0009] As mentioned above, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station constituted small can wash a substrate through a different washing process.

[0010] Moreover, in a substrate washing station according to claim 2, it is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by being pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with said drive.

[0011] Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0012] With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing is carried out, and spin desiccation can be carried out after this pencil scrub washing is completed.

[0013] Moreover, it is characterized by for the upper case washing unit having arranged the drive in a substrate washing station according to claim 1 more nearly up than a substrate maintenance device in invention according to claim 3, and the lower-berth washing unit having arranged the drive caudad from the substrate maintenance device.

[0014] When the upper case washing unit has arranged the drive as mentioned above more nearly up than a substrate maintenance device and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance device of vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0015] In a substrate washing station according to claim 1, invention according to claim 4 will be characterized by carrying in to the washing unit of another side with a carrier robot, if a carrier robot is provided, a substrate is carried in to one washing unit of the vertical stage washing units with this carrier robot and washing termination is carried out.

[0016] Since it will carry in to the washing unit of another side with a carrier robot if a substrate is

carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot as mentioned above, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0017] Moreover, in a substrate washing station according to claim 1, it is characterized by providing the ***** device which has been over up about the upper case washing unit.

[0018] By providing a ***** device as mentioned above, the maintenance of the parts replacement of the washing unit of a vertical stage, washing, etc. becomes easy in the condition of having bounded up, about an upper case washing unit.

[0019] Moreover, in a substrate washing station according to claim 2, invention according to claim 5 is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by to be pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with a drive.

[0020] Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0021] With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

[0022]

[Embodiment of the Invention] Hereafter, the example of a gestalt of operation of this invention is explained based on a drawing. Drawing 1 thru/or drawing 4 are drawings showing the configuration of the substrate washing station concerning this invention, and drawing 1 is drawing in which in the whole substrate washing station configuration and drawing 2 the upper case washing unit configuration of a substrate washing station and drawing 3 show the lower-berth washing unit configuration of a substrate washing station, and drawing 4 shows a carrier robot's configuration, respectively. This substrate washing station has arranged the upper case washing unit 10 and the lower-berth washing unit 50 up and down, the penetrant remover drain pan 41 has been arranged in the middle, and the batch has separated the upper case washing unit 10 and the lower-berth washing unit 50 so that it may illustrate. Moreover, it can have bounded up and the upper case washing unit 10 can be rotated now, as shown in drawing 5 through a hinge 51. The upper case washing unit 10 is positioned by the positioning stopper 83 attached in the casing 54 of the lower-berth washing unit 50, when it lowered and takes down through a hinge 51.

[0023] The upper case washing unit 10 possesses the drive 12 which drives the substrate maintenance device 11 and this substrate maintenance device 11 which Substrate W is held. The part except the drive 12 of the upper case washing unit 10 is covered by casing 13, an inlet 14 and a jet pipe 15 are formed in this casing 13, and the taking-out inlet port 16 which performs the taking-out close of Substrate W further is formed. Moreover, the gate 17 opened and closed by cylinder 17a is established in the taking-out inlet port 16. Moreover, a drive 12 is carried on casing 13 and covered by casing 40.

[0024] As shown in drawing 6, the substrate maintenance device 11 possesses Chuck Laura [two or more (drawing four pieces)] 18 arranged at equal intervals at the periphery section of Substrate W, and this chuck roller 18 fixes to the lower limit of a spindle 19, respectively, and it rotates each spindle 19 by the motor 20 of a drive 12. Moreover, each spindle 19 can be moved now in the direction of a path of Substrate W in a cylinder 21, and pinches Substrate W by actuation of this cylinder 21 in two or more Chuck Laura 18, and by rotation of a motor 20, Substrate W rotates it, as shown in an arrow head A. In addition, drawing 6 is the B-B sectional view of drawing 2.

[0025] 22 and 23 are the upper roll sponge which becomes with the roll mold washing fixture which washes both sides of the upper and lower sides of Substrate W, and bottom roll sponge, respectively. The bevel gear 26 which mesh with the bevel gear 25 which fixed to the lower limit of a spindle 24 in the edge of upper roll sponge 22 fix, and by rotation of a motor 27, as shown in an arrow head D, it rotates. Moreover, the bevel gear 30 which mesh with the bevel gear 29 which fixed also at the lower limit of a spindle 28 or edge of bottom roll sponge 23 fix, and by rotation of a motor 31, as shown in an arrow head E, it rotates.

[0026] Moreover, a spindle 24 can be moved now in the vertical direction in a cylinder 33 in the direction

of a path of Substrate W in a cylinder 32, and, thereby, can move upper roll sponge 22 in the direction of a path and the vertical direction of Substrate W. Similarly, a spindle 28 can be moved now in the vertical direction in a cylinder 34 in the direction of a path of Substrate W in a cylinder (not shown), and, thereby, can move bottom roll sponge 23 in the direction of a path and the vertical direction of Substrate W. 35 is a cleaning tub for carrying out self-cleaning of the upper roll sponge 22. Moreover, although illustration is omitted, the cleaning tub for carrying out self-cleaning of the bottom roll sponge 23 is also prepared. [0027] 36 is an upper penetrant remover nozzle for injecting a penetrant remover on the top face of Substrate W, and 37 is a bottom penetrant remover nozzle for injecting a penetrant remover on the inferior surface of tongue of Substrate W. The periphery of the substrate maintenance device 11 is surrounded with the upper case process cup 38, and this upper case process cup 38 can move up and down now in a cylinder 39.

[0028] The lower-berth washing unit 50 possesses the drive 53 which drives the substrate maintenance device 52 and this substrate maintenance device 52 which Substrate W is held. As for the lower-berth washing unit 50, the whole is covered by casing 54. The inlet 55 and the exhaust port 56 are established in this casing 54. The downflow air jet hole duct 57 arranged in the upper part of casing 54 on the inferior surface of tongue of the penetrant remover drain pan 41 is open for free passage to this inlet 55, and is opening the jet pipe 58 for free passage for the exhaust port 56. Moreover, the taking-out inlet port 60 which performs the taking-out close of Substrate W is established in casing 54, and the gate 61 opened and closed by cylinder 61a is established in this taking-out inlet port 60.

[0029] The substrate maintenance device 52 possesses the wafer chuck wheel 62 which has the pawl [two or more (drawing four pieces)] 63 in the periphery section, as shown in drawing 7. A pawl 63 consists of fixed pawl 63b and movable pawl 63a, fixed pawl 63b is fixed to the periphery section top face of the wafer chuck wheel 62, and movable pawl 63a is supported by this fixed pawl 63b free [rotation] by shaft 63c. This movable pawl 63a rotates to hard flow (direction which opens a pawl 63) by ****(ing) the end of rod 63e, being energized by the one direction (direction which closes a pawl 63) focusing on shaft 63c by spring 63d resiliency, and always operating the pawl driving cylinder 64. That is, the periphery section of Substrate W is pinched by fixed pawl 63b and movable pawl 63a by operating the pawl driving cylinder 64, laying Substrate W on fixed pawl 63b, where a pawl 63 is opened (condition of having rotated movable pawl 63a focusing on shaft 63c), and making the pawl driving cylinder 64 non-operative. In addition, drawing 7 is the F-F view Fig. of drawing 3.

[0030] The wafer chuck wheel 62 is rotated by the motor 65. This motor 65 and the pawl driving cylinder 64 constitute the drive 53 which drives the substrate maintenance device 52. Moreover, the wafer chuck wheel 62 is surrounded with the lower-berth process cup 66 arranged at the periphery, and this lower-berth process cup 66 can move up and down now in a cylinder 78. The washing drain pan 67 is arranged under the wafer chuck wheel 62.

[0031] 68 is the pencil sponge used as the pencil mold washing fixture which washes upper both sides of Substrate W, and this pencil sponge 68 is connected with a motor 86 through a spindle 69, a pulley 70, a belt 71, a pulley 72, and a spindle 73, and as rotation of this motor 86 shows to an arrow head G, it rotates. The pulley 70, the belt 71, the pulley 72, and the spindle 73 are held in the washing arm 74. This washing arm 74 is connected with a motor 75 through a belt 77 and a pulley 76, and as shown in the arrow head H of drawing 7, it can be circled now in it. Moreover, the washing arm 74 can move up and down now in a cylinder 79.

[0032] 80 is a cleaning tub for carrying out self-cleaning of the pencil sponge 68. 81 is an upper penetrant remover nozzle which injects a penetrant remover on the top face of the substrate W held at the substrate maintenance device 52, and 82 is a bottom penetrant remover nozzle which injects a penetrant remover on the inferior surface of tongue of this substrate W. 90 is a carrier robot which adjoined the substrate washing station and has been stationed, and as shown in drawing 4, this carrier robot 90 has the hand, the upper hand 91 and the bottom hand 92, of two, moves both the hands 91 and 92 in the vertical direction, makes it circle, he makes a level radial expand and contract and can position each hand 91 and 92 now.

[0033] In the substrate washing station of the above-mentioned configuration, the air 101 inhaled from the inlet 14 of the upper case washing unit 10 is exhausted through a jet pipe 15. Moreover, the air 102 inhaled from the inlet 55 of the lower-berth washing unit 50 serves as a downflow, flows out of nozzle opening 57a of the downflow air jet hole duct 57, and is discharged from a jet pipe 58. Moreover, in the

upper case washing unit 10, the penetrant remover 103 used for substrate washing flows down to the penetrant remover drain pan 41, and is discharged through the effluent duct 84. Moreover, in the lower-berth washing unit 50, the penetrant remover 104 used for substrate washing flows down to the penetrant remover drain pan 67, and is discharged through the effluent duct 85.

[0034] On the occasion of washing of Substrate W, Substrate W is first received from the last process of washing by the hand 92 under a carrier robot 90. next, the gate 17 of the upper case washing unit 10 is gone up by actuation of cylinder 17a -- making (it opening) -- a process cup 38 is raised by actuation of a cylinder 39. Next, a carrier robot 90 inserts the bottom hand 92 from the taking-out inlet port 16, and the substrate W to hold retreats delivery and this upper hand 92 to Chuck Laura 18 of the substrate maintenance device 11. in this condition, the gate 17 is descended by actuation of cylinder 17a -- making (it closing) -- a process cup is dropped by actuation of a cylinder 39. The substrate maintenance device 11 in which this held Substrate W will be in the condition of having surrounded the perimeter with the upper case process cup 38, and a penetrant remover will cease to disperse. Pinching Substrate W by actuation of a cylinder 21 as mentioned above in two or more Chuck Laura 18, Substrate W rotates by rotation of a motor 20.

[0035] Injecting a penetrant remover to the vertical side of Substrate W from the upper penetrant remover nozzle 36 and the bottom penetrant remover nozzle 37, contact the top face of Substrate W in upper roll sponge 22, contact the inferior surface of tongue of Substrate W in bottom roll sponge 23, respectively, it is made to rotate, and the vertical side of Substrate W is washed. After washing termination raises the upper case process cup 38 while raising the gate 17. A carrier robot 90 inserts the bottom hand 92 in the interior from the taking-out inlet port 16, does reception retreat of the substrate W after washing termination, and descends to the location of the taking-out inlet port 60 of the lower-berth washing unit 50. next, the gate 61 is descended by actuation of cylinder 61a -- making (it opening) -- the lower-berth process cup 66 is dropped by actuation of a cylinder 78, the bottom hand 92 is inserted from the taking-out inlet port 60, and the substrate W to hold is passed to the substrate maintenance device 52 of the lower-berth washing unit 50. Then, the upper hand 91 retreats, goes up and performs [Substrate W] delivery and washing for Substrate W to Chuck Laura 18 of the substrate maintenance device 11 of the upper case washing unit 10 by the receipt and the same actuation as the above from the last process of washing.

[0036] After the substrate maintenance device 52 of the lower-berth washing unit 50 receives the substrate W after washing termination in the upper case washing unit 10, it pinches the periphery section of Substrate W by fixed pawl 63b and movable pawl 63a of a pawl 63, and holds Substrate W. Then, the gate 61 is raised while raising the lower-berth process cup 66 (it closes). The substrate maintenance device 52 in which this held Substrate W will be in the condition of having been surrounded by the lower-berth process cup 66 grade, and a penetrant remover will cease to disperse. A motor 65 is started in this condition and Substrate W is rotated in a low-speed field (for example, below 200rpm extent). While injecting a penetrant remover to the vertical side of the substrate W held by the substrate maintenance device 52 from the upper penetrant remover nozzle 81 and the bottom penetrant remover nozzle 82, the top face of Substrate W is contacted rotating pencil sponge 68, and Substrate W is washed.

[0037] A motor 86 performs rotation of pencil sponge 68, and the contact to a substrate W top face is performed by dropping the washing arm 74 in a cylinder 79. Moreover, pencil sponge 68 will circle by making it circle in the washing arm 74 by the motor 75, rotating the top face of Substrate W. Pencil sponge 68 passes through the center of rotation of Substrate W, rocks it to the outer edge of Substrate W, and washes Substrate W. Supersonic vibration is given by the ultrasonic energy grant means which is not illustrated to pencil sponge 68 the very thing or a penetrant remover at this time, a cleaning effect may be raised or the cleaning effect by cavitation destructive operation may be raised with a means to make a penetrant remover cause cavitation. And after washing termination makes it circle in the washing arm 74 to the outside of Substrate W, inserts pencil sponge 68 into the cleaning tub 80, and carries out self-cleaning. moreover, after washing termination of Substrate W carries out high-speed rotation (for example, 1,000rpm - 4,000rpm) of the substrate W by the motor 85, and disperses the penetrant remover adhering to a front face with a centrifugal force -- making -- desiccation -- being the so-called -- spin desiccation is carried out.

[0038] after spin desiccation termination drops the gate 61 -- the lower-berth process cup 66 is both

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dropped. in this condition, a carrier robot's 90 upper hand 91 is inserted into the lower-berth washing unit 50 from the taking-out inlet port 60, from the substrate maintenance device 52, it is made to retreat and that substrate W to hold is contained to a receipt and the cassette which does not illustrate this substrate W. After retreat of the upper hand 91 raises the lower-berth process cup 66 while raising the gate 61. Of course, while raising the gate 61 like the above after carrying in Substrate W by the bottom hand 92 when carrying in the substrate W which washing ended in the upper case washing unit 10 continuously, the lower-berth process cup 66 is raised and washing and spin desiccation are performed. [0039] In addition, although the upper case washing unit 10 was made into roll/roll scrubber washing unit possessing two roll mold washing implements in the above-mentioned example and having carried out as the substrate washing station considering the lower-berth washing unit 50 as pencil scrub washing and a spin-dry unit possessing a pencil mold washing implement, both the substrate washing stations that apply to this invention may constitute the upper case washing unit 10 and a lower-berth washing unit 50 at roll/roll scrubber washing unit, as shown in drawing 8 .

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the whole substrate washing station configuration concerning this invention.

[Drawing 2] It is drawing showing the upper case washing unit configuration of the substrate washing station concerning this invention.

[Drawing 3] It is drawing showing the lower-berth washing unit configuration of the substrate washing station concerning this invention.

[Drawing 4] It is drawing showing the configuration of the carrier robot of the substrate washing station concerning this invention.

[Drawing 5] It is drawing showing the condition of having bounded the upper case washing unit of the substrate washing station concerning this invention.

[Drawing 6] It is the B-B sectional view of drawing 2.

[Drawing 7] It is the F-F sectional view of drawing 3.

[Drawing 8] It is drawing showing the whole substrate washing station configuration concerning this invention.

[Description of Notations]

- 10 Upper Case Washing Unit
- 11 Substrate Maintenance Device
- 12 Drive
- 16 Taking-Out Inlet Port
- 17 Closing Motion Gate
- 18 Chuck Laura
- 22 Upper Roll Sponge
- 23 Bottom Roll Sponge
- 36 Upper Penetrant Remover Nozzle
- 37 Bottom Penetrant Remover Nozzle
- 38 Upper Case Process Cup
- 41 Penetrant Remover Drain Pan
- 50 Lower-Berth Washing Unit
- 51 Hinge
- 52 Substrate Maintenance Device
- 53 Drive
- 60 Taking-Out Inlet Port
- 61 Closing Motion Gate
- 62 Wafer Chuck Wheel
- 63 Pawl
- 64 Pawl Driving Cylinder
- 66 Lower-Berth Process Cup
- 67 Penetrant Remover Drain Pan
- 68 Pencil Sponge
- 74 Washing Arm

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81 Upper Penetrant Remover Nozzle
82 Bottom Penetrant Remover Nozzle
83 Positioning Stopper
84 Effluent Duct
90 Carrier Robot

http://www.tjpc.jp/ NO. 1851 P. 22/80

[Translation done.]

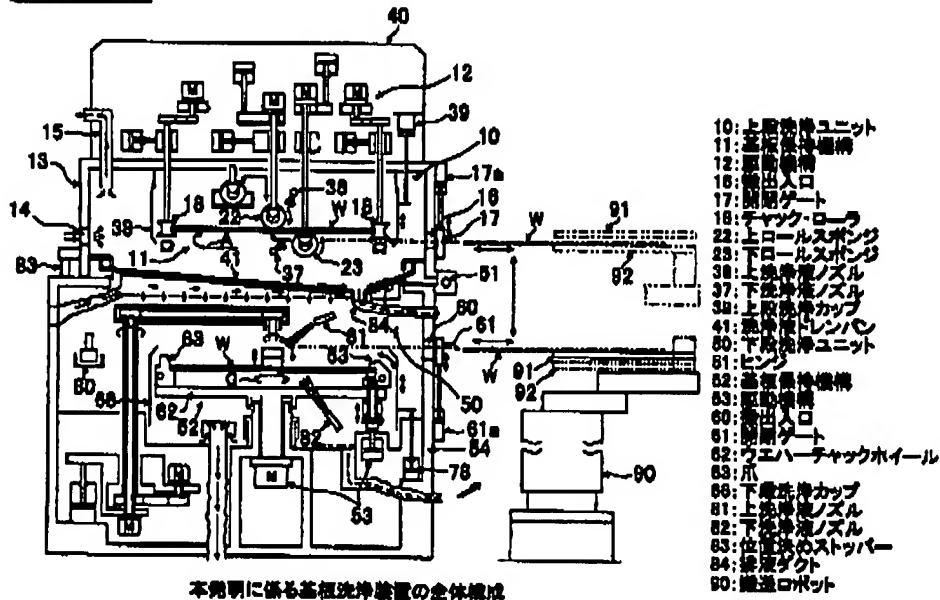
* NOTICES *

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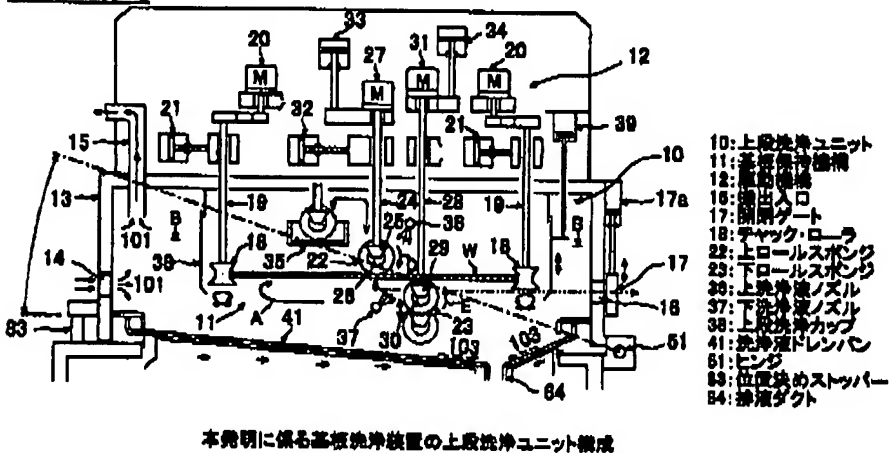
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DRAWINGS

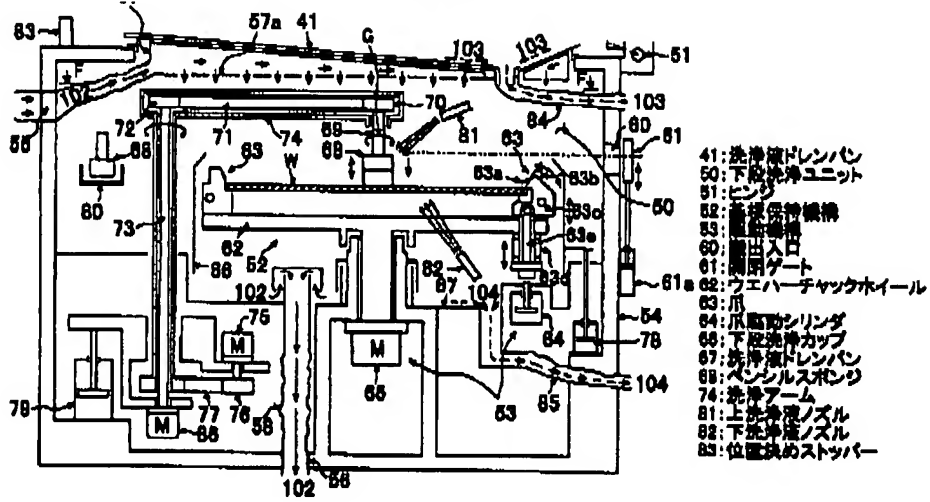
[Drawing 1]



[Drawing 2]



[Drawing 3]



本発明に係る洗浄装置の下段洗浄ユニット構成

[Drawing 6]

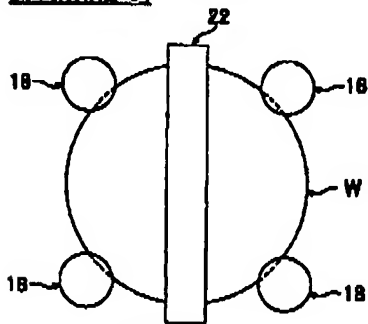
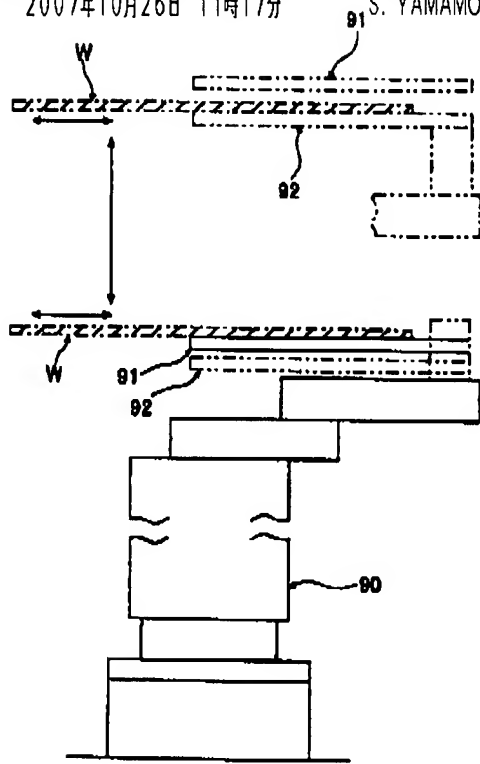
18: チェック・ローラ
22: 上ロールスポンジ

図2のB-B断面図

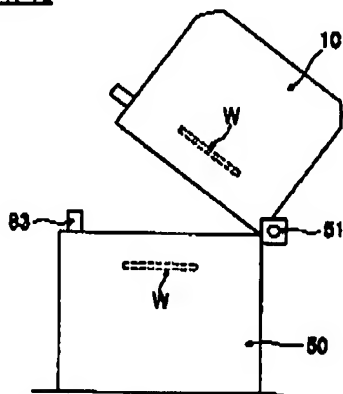
[Drawing 4]



90:搬送ロボット

本発明に係る基礎洗浄装置の搬送ロボットの構成

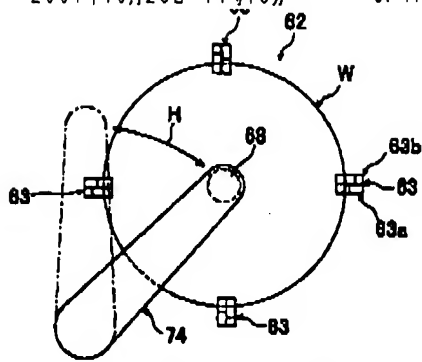
[Drawing 5]



10:上段洗浄ユニット 51:ヒンジ
50:下段洗浄ユニット 53:位置決めストッパー

本発明に係る基礎洗浄装置の上段洗浄ユニットを翻ね上げた状態

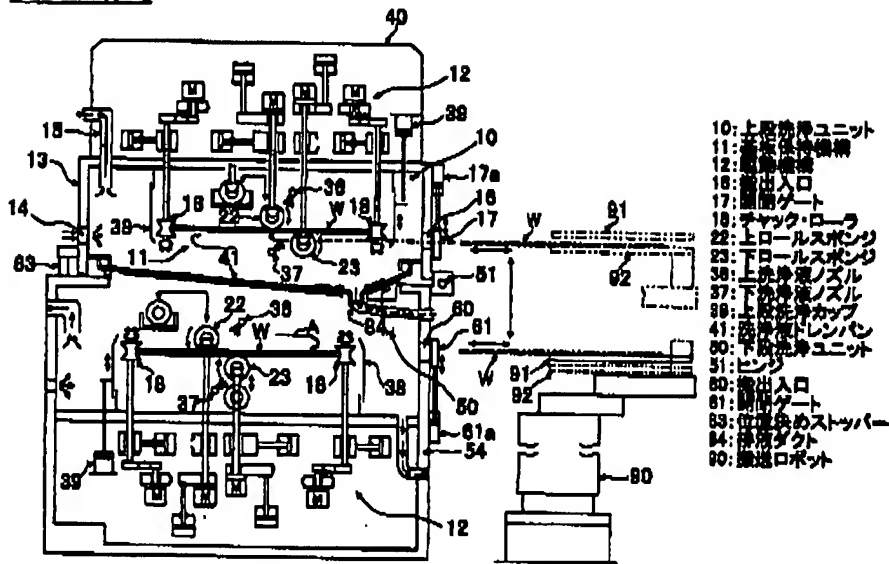
[Drawing 7]



62: ウエハーチェックホイール
63: 爪
68: ペンシルスポンジ
74: 洗浄アーム

図3のF-F断面図

[Drawing 8]



本発明に係る基板洗浄装置の全体構成

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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
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B65G 49/07
H01L 21/68

[F1]

H01L 21/304	643	A
H01L 21/304	644	C
H01L 21/304	648	A
B25J 9/06		D
B65G 49/07		C
H01L 21/68		A

[Procedure revision]
[Filing Date] January 24, Heisei 17 (2005. 1.24)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Whole sentence
[Method of Amendment] Modification
[The contents of amendment]
[Document Name] Specification
[Title of the Invention] A substrate washing station and the substrate washing approach
[Claim(s)]

[Claim 1] The substrate washing station characterized by having arranged the washing unit possessing the drive which drives the substrate maintenance device and this substrate maintenance device which a substrate is held to two steps of upper and lower sides.

[Claim 2] In a substrate washing station according to claim 1,

The substrate washing station characterized by being the washing unit which enforces the washing approach by which said upper case washing unit differed from the lower-berth washing unit mutually.

[Claim 3] In a substrate washing station according to claim 1,

It is the substrate washing station characterized by for said upper case washing unit having arranged said drive more nearly up than said substrate maintenance device, and said lower-berth washing unit having arranged said drive caudad from said substrate maintenance device.

[Claim 4] In a substrate washing station according to claim 1,

The substrate washing station characterized by carrying in to the washing unit of another side with said carrier robot if a carrier robot is provided, a substrate is carried in to one washing unit of said vertical stage washing units with this carrier robot and washing termination is carried out.

[Claim 5] In a substrate washing station according to claim 2,

The substrate washing station characterized by being roll/roll scrubber washing unit to which either of said vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and being penoil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with said drive.

[Claim 6] The substrate washing approach characterized by carrying in a substrate and a carrier robot washing a substrate to one washing unit of the washing units arranged to two steps of upper and lower sides possessing the drive which drives the substrate maintenance device and this substrate maintenance device which a substrate is held, and carrying in to the washing unit of another side this substrate that washing ended, and washing it with said carrier robot.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the substrate washing station and the substrate washing approach of washing substrates, such as a semi-conductor wafer, through the washing process from which plurality differs.

[0002]

[Description of the Prior Art]

With improvement in the degree of integration of a semiconductor device, a high air cleanliness class is required also of washing of a substrate, and it is washed through the washing process from which plurality differs. The conventional substrate washing station arranges separately the washing unit which carries out a different washing process to a horizontal plane, conveys a substrate between washing units using a carrier robot, washes it through washing by these two or more washing units, and is drying the substrate after washing termination.

[0003]

As mentioned above, it has the problem of needing a large installation tooth space while equipment enlarges it, since the conventional washing station arranges two or more washing units to the horizontal plane. Moreover, the problem that became large and a carrier robot's business area became large also had the migration length of the carrier robot which conveys a substrate. Moreover, since two or more washing units are arranged horizontally, when depth becomes large and maintains exchange, washing, etc. of components etc., it cannot access from one side face, but there is a problem that it must access from two or more side faces.

[0004]

As mentioned above, when for example, floor line cost installs a washing station in an expensive clean room, since the problem that a large installation tooth space must be needed or the maintenance of exchange, washing, etc. of components etc. must be accessed from two or more side faces needs a big tooth space, it is inconvenient.

[0005]

[Problem(s) to be Solved by the Invention]

It aims at this invention having been made in view of the above-mentioned point, being able to remove the above-mentioned problem, and being able to miniaturize it, and installation area being small, and ending and the maintenance of exchange, washing, etc. of components etc. offering an easy substrate washing station and the substrate washing approach.

[0006]

[Means for Solving the Problem]

In order to solve the above-mentioned technical problem, the substrate washing station characterized by having arranged the washing unit possessing the drive which drives the substrate maintenance device

[0007]

Since the washing unit has been arranged to two steps of upper and lower sides as mentioned above, while being able to miniaturize the whole equipment, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0008]

Moreover, invention according to claim 2 is characterized by being the washing unit which enforces the washing approach by which the upper case washing unit differed from the lower-berth washing unit mutually in a substrate washing station according to claim 1.

[0009]

As mentioned above, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station constituted small can wash a substrate through a different washing process.

[0010]

Moreover, in a substrate washing station according to claim 2, it is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by being pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with said drive.

[0011]

Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0012]

With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing is carried out, and spin desiccation can be carried out after this pencil scrub washing is completed.

[0013]

Moreover, it is characterized by for the upper case washing unit having arranged the drive in a substrate washing station according to claim 1 more nearly up than a substrate maintenance device in invention according to claim 3, and the lower-berth washing unit having arranged the drive caudad from the substrate maintenance device.

[0014]

When the upper case washing unit has arranged the drive as mentioned above more nearly up than a substrate maintenance device and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance device of vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0015]

In a substrate washing station according to claim 1, invention according to claim 4 will be characterized by carrying in to the washing unit of another side with a carrier robot, if a carrier robot is provided, a substrate is carried in to one washing unit of the vertical stage washing units with this carrier robot and washing termination is carried out.

[0016]

Since it will carry in to the washing unit of another side with a carrier robot if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot as mentioned above, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0017]

Moreover, in a substrate washing station according to claim 1, it is characterized by providing the

***** device which has been over up about the upper case washing unit.

[0018]

By providing a ***** device as mentioned above, the maintenance of the parts replacement of the washing unit of a vertical stage, washing, etc. becomes easy in the condition of having bounded up, about an upper case washing unit.

[0019]

Moreover, in a substrate washing station according to claim 2, invention according to claim 5 is roll/roll scrubber washing unit to which either of the vertical stage washing units possesses two roll mold washing implements which wash both sides of a substrate, respectively, and is characterized by to be pencil scrub washing and the spin-dry unit which carries out spin desiccation of the substrate with which another side possessed and washed the pencil mold washing implement with a drive.

[0020]

Moreover, in the above-mentioned substrate washing station, an upper case washing unit is roll/roll scrubber washing unit, and it is characterized by lower-berth washing units being pencil scrub washing and a spin-dry unit.

[0021]

With the substrate washing station constituted small by considering as roll/roll scrubber washing unit as mentioned above, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

[0022]

Moreover, it is to the substrate washing approach characterized by for invention according to claim 6 to carry in a substrate, and to wash a substrate with a carrier robot to one washing unit of the washing units arranged to two steps of upper and lower sides possessing the drive which drives the substrate maintenance device and this substrate maintenance device in which a substrate is held, and to carry in to the washing unit of another side this substrate that washing ended, and to wash it with said carrier robot.

[0023]

Since it will carry in to the washing unit of another side and will wash if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot as mentioned above, installation area of a washing unit can be made small, and a carrier robot's migration length can be lessened, and efficient substrate washing can be performed.

[0024]

[Embodiment of the Invention]

Hereafter, the example of a gestalt of operation of this invention is explained based on a drawing.

Drawing 1 thru/or drawing 4 are drawings showing the configuration of the substrate washing station concerning this invention, and drawing 1 is drawing in which in the whole substrate washing station configuration and drawing 2 the upper case washing unit configuration of a substrate washing station and drawing 3 show the lower-berth washing unit configuration of a substrate washing station, and drawing 4 shows a carrier robot's configuration, respectively. This substrate washing station has arranged the upper case washing unit 10 and the lower-berth washing unit 50 up and down, the penetrant remover drain pan 41 has been arranged in the middle, and the batch has separated the upper case washing unit 10 and the lower-berth washing unit 50 so that it may illustrate. Moreover, it can have bounded up and the upper case washing unit 10 can be rotated now, as shown in drawing 5 through a hinge 51. The upper case washing unit 10 is positioned by the positioning stopper 83 attached in the casing 54 of the lower-berth washing unit 50, when it lowered and takes down through a hinge 51.

[0025]

The upper case washing unit 10 possesses the drive 12 which drives the substrate maintenance device 11 and this substrate maintenance device 11 which Substrate W is held. The part except the drive 12 of the upper case washing unit 10 is covered by casing 13, an inlet 14 and a jet pipe 15 are formed in this casing 13, and the taking-out inlet port 16 which performs the taking-out close of Substrate W further is formed. Moreover, the gate 17 opened and closed by cylinder 17a is established in the taking-out inlet port 16. Moreover, a drive 12 is carried on casing 13 and covered by casing 40.

[0026]

As shown in drawing 6, the substrate maintenance device 11 possesses Chuck Laura [two or more (drawing four pieces)] 18 arranged at equal intervals at the periphery section of Substrate W, and this chuck roller 18 fixes to the lower limit of a spindle 19, respectively, and it rotates each spindle 19 by the motor 20 of a drive 12. Moreover, each spindle 19 can be moved now in the direction of a path of Substrate W in a cylinder 21, and pinches Substrate W by actuation of this cylinder 21 in two or more Chuck Laura 18, and by rotation of a motor 20, Substrate W rotates it, as shown in an arrow head A. In addition, drawing 6 is the B-B sectional view of drawing 2.

[0027]

22 and 23 are the upper roll sponge which becomes with the roll mold washing fixture which washes both sides of the upper and lower sides of Substrate W, and bottom roll sponge, respectively. The bevel gear 26 which mesh with the bevel gear 25 which fixed to the lower limit of a spindle 24 in the edge of upper roll sponge 22 fix, and by rotation of a motor 27, as shown in an arrow head D, it rotates. Moreover, the bevel gear 30 which mesh with the bevel gear 29 which fixed also at the lower limit of a spindle 28 or edge of bottom roll sponge 23 fix, and by rotation of a motor 31, as shown in an arrow head E, it rotates.

[0028]

Moreover, a spindle 24 can be moved now in the vertical direction in a cylinder 33 in the direction of a path of Substrate W in a cylinder 32, and, thereby, can move upper roll sponge 22 in the direction of a path and the vertical direction of Substrate W. Similarly, a spindle 28 can be moved now in the vertical direction in a cylinder 34 in the direction of a path of Substrate W in a cylinder (not shown), and, thereby, can move bottom roll sponge 23 in the direction of a path and the vertical direction of Substrate W. 35 is a cleaning tub for carrying out self-cleaning of the upper roll sponge 22. Moreover, although illustration is omitted, the cleaning tub for carrying out self-cleaning of the bottom roll sponge 23 is also prepared.

[0029]

36 is an upper penetrant remover nozzle for injecting a penetrant remover on the top face of Substrate W, and 37 is a bottom penetrant remover nozzle for injecting a penetrant remover on the inferior surface of tongue of Substrate W. The periphery of the substrate maintenance device 11 is surrounded with the upper case process cup 38, and this upper case process cup 38 can move up and down now in a cylinder 39.

[0030]

The lower-berth washing unit 50 possesses the drive 53 which drives the substrate maintenance device 52 and this substrate maintenance device 52 which Substrate W is held. As for the lower-berth washing unit 50, the whole is covered by casing 54. The inlet 55 and the exhaust port 58 are established in this casing 54. The downflow air jet hole duct 57 arranged in the upper part of casing 54 on the inferior surface of tongue of the penetrant remover drain pan 41 is open for free passage to this inlet 55, and is opening the jet pipe 58 for free passage for the exhaust port 58. Moreover, the taking-out inlet port 60 which performs the taking-out close of Substrate W is established in casing 54, and the gate 61 opened and closed by cylinder 61a is established in this taking-out inlet port 60.

[0031]

The substrate maintenance device 52 possesses the wafer chuck wheel 62 which has the pawl [two or more (drawing four pieces)] 63 in the periphery section, as shown in drawing 7. A pawl 63 consists of fixed pawl 63b and movable pawl 63a, fixed pawl 63b is fixed to the periphery section top face of the wafer chuck wheel 62, and movable pawl 63a is supported by this fixed pawl 63b free [rotation] by shaft 63c. This movable pawl 63a rotates to hard flow (direction which opens a pawl 63) by ****(ing) the end of rod 63e, being energized by the one direction (direction which closes a pawl 63) focusing on shaft 63c by spring 63d resiliency, and always operating the pawl driving cylinder 64. That is, the periphery section of Substrate W is pinched by fixed pawl 63b and movable pawl 63a by operating the pawl driving cylinder 64, laying Substrate W on fixed pawl 63b, where a pawl 63 is opened (condition of having rotated movable pawl 63a focusing on shaft 63c), and making the pawl driving cylinder 64 non-operative. In addition, drawing 7 is the F-F view Fig. of drawing 3.

[0032]

The wafer chuck wheel 62 is rotated by the motor 65. This motor 65 and the pawl driving cylinder 64 constitute the drive 53 which drives the substrate maintenance device 52. Moreover, the wafer chuck wheel 62 is surrounded with the lower-berth process cup 66 arranged at the periphery, and this lower-berth process cup 66 can move up and down now in a cylinder 78. The washing drain pan 67 is

[0033]

68 is the pencil sponge used as the pencil mold washing fixture which washes upper both sides of Substrate W, and this pencil sponge 68 is connected with a motor 86 through a spindle 69, a pulley 70, a belt 71, a pulley 72, and a spindle 73, and as rotation of this motor 86 shows to an arrow head G, it rotates. The pulley 70, the belt 71, the pulley 72, and the spindle 73 are held in the washing arm 74. This washing arm 74 is connected with a motor 75 through a belt 77 and a pulley 76, and as shown in the arrow head H of drawing 7, it can be circled now in it. Moreover, the washing arm 74 can move up and down now in a cylinder 79.

[0034]

80 is a cleaning tub for carrying out self-cleaning of the pencil sponge 68. 81 is an upper penetrant remover nozzle which injects a penetrant remover on the top face of the substrate W held at the substrate maintenance device 52, and 82 is a bottom penetrant remover nozzle which injects a penetrant remover on the inferior surface of tongue of this substrate W. 90 is a carrier robot which adjoined the substrate washing station and has been stationed, and as shown in drawing 4, this carrier robot 90 has the hand, the upper hand 91 and the bottom hand 92, of two, moves both the hands 91 and 92 in the vertical direction, makes it circle, he makes a level radial expand and contract and can position each hand 91 and 92 now.

[0035]

In the substrate washing station of the above-mentioned configuration, the air 101 inhaled from the inlet 14 of the upper case washing unit 10 is exhausted through a jet pipe 15. Moreover, the air 102 inhaled from the inlet 55 of the lower-berth washing unit 50 serves as a downflow, flows out of nozzle opening 57a of the downflow air jet hole duct 57, and is discharged from a jet pipe 58. Moreover, in the upper case washing unit 10, the penetrant remover 103 used for substrate washing flows down to the penetrant remover drain pan 41, and is discharged through the effluent duct 84. Moreover, in the lower-berth washing unit 50, the penetrant remover 104 used for substrate washing flows down to the penetrant remover drain pan 67, and is discharged through the effluent duct 85.

[0036]

On the occasion of washing of Substrate W, Substrate W is first received from the last process of washing by the hand 92 under a carrier robot 90. next, the gate 17 of the upper case washing unit 10 is gone up by actuation of cylinder 17a -- making (it opening) -- a process cup 38 is raised by actuation of a cylinder 39. Next, a carrier robot 90 inserts the bottom hand 92 from the taking-out inlet port 16, and the substrate W to hold retreats delivery and this upper hand 92 to Chuck Laura 18 of the substrate maintenance device 11. in this condition, the gate 17 is descended by actuation of cylinder 17a -- making (it closing) -- a process cup is dropped by actuation of a cylinder 39. The substrate maintenance device 11 in which this held Substrate W will be in the condition of having surrounded the perimeter with the upper case process cup 38, and a penetrant remover will cease to disperse. Pinching Substrate W by actuation of a cylinder 21 as mentioned above in two or more Chuck Laura 18, Substrate W rotates by rotation of a motor 20.

[0037]

Injecting a penetrant remover to the vertical side of Substrate W from the upper penetrant remover nozzle 36 and the bottom penetrant remover nozzle 37, contact the top face of Substrate W in upper roll sponge 22, contact the inferior surface of tongue of Substrate W in bottom roll sponge 23, respectively, it is made to rotate, and the vertical side of Substrate W is washed. After washing termination raises the upper case process cup 38 while raising the gate 17. A carrier robot 90 inserts the bottom hand 92 in the interior from the taking-out inlet port 16, does reception retreat of the substrate W after washing termination, and descends to the location of the taking-out inlet port 60 of the lower-berth washing unit 50. next, the gate 61 is descended by actuation of cylinder 61a -- making (it opening) -- the lower-berth process cup 66 is dropped by actuation of a cylinder 78, the bottom hand 92 is inserted from the taking-out inlet port 60, and the substrate W to hold is passed to the substrate maintenance device 52 of the lower-berth washing unit 50. Then, the upper hand 91 retreats, goes up and performs [Substrate W] delivery and washing for Substrate W to Chuck Laura 18 of the substrate maintenance device 11 of the upper case washing unit 10 by the receipt and the same actuation as the above from the last process of washing.

[0038]

After the substrate maintenance device 52 of the lower-berth washing unit 50 receives the substrate W after washing termination in the upper case washing unit 10, it pinches the periphery section of Substrate W by fixed pawl 63b and movable pawl 63a of a pawl 63, and holds Substrate W. Then, the gate 61 is raised while raising the lower-berth process cup 66 (it closes). The substrate maintenance device 52 in which this held Substrate W will be in the condition of having been surrounded by the lower-berth process cup 66 grade, and a penetrant remover will cease to disperse. A motor 65 is started in this condition and Substrate W is rotated in a low-speed field (for example, below 200rpm extent). While injecting a penetrant remover to the vertical side of the substrate W held by the substrate maintenance device 52 from the upper penetrant remover nozzle 81 and the bottom penetrant remover nozzle 82, the top face of Substrate W is contacted rotating pencil sponge 68, and Substrate W is washed.

[0039]

A motor 86 performs rotation of pencil sponge 68, and the contact to a substrate W top face is performed by dropping the washing arm 74 in a cylinder 79. Moreover, pencil sponge 68 will circle by making it circle in the washing arm 74 by the motor 75, rotating the top face of Substrate W. Pencil sponge 68 passes through the center of rotation of Substrate W, rocks it to the outer edge of Substrate W, and washes Substrate W. Supersonic vibration is given by the ultrasonic energy grant means which is not illustrated to pencil sponge 68 the very thing or a penetrant remover at this time, a cleaning effect may be raised or the cleaning effect by cavitation destructive operation may be raised with a means to make a penetrant remover cause cavitation. And after washing termination makes it circle in the washing arm 74 to the outside of Substrate W, inserts pencil sponge 68 into the cleaning tub 80, and carries out self-cleaning. moreover, after washing termination of Substrate W carries out high-speed rotation (for example, 1,000rpm - 4,000rpm) of the substrate W by the motor 65, and disperses the penetrant remover adhering to a front face with a centrifugal force -- making -- desiccation -- being the so-called -- spin desiccation is carried out.

[0040]

after spin desiccation termination drops the gate 61 -- the lower-berth process cup 66 is both dropped. In this condition, a carrier robot's 90 upper hand 91 is inserted into the lower-berth washing unit 50 from the taking-out inlet port 60, from the substrate maintenance device 52, it is made to retreat and that substrate W to hold is contained to a receipt and the cassette which does not illustrate this substrate W. After retreat of the upper hand 91 raises the lower-berth process cup 66 while raising the gate 61. Of course, while raising the gate 61 like the above after carrying in Substrate W by the bottom hand 92 when carrying in the substrate W which washing ended in the upper case washing unit 10 continuously, the lower-berth process cup 66 is raised and washing and spin desiccation are performed.

[0041]

In addition, although the upper case washing unit 10 was made into roll/roll scrubber washing unit possessing two roll mold washing implements in the above-mentioned example and having carried out as the substrate washing station considering the lower-berth washing unit 50 as pencil scrub washing and a spin-dry unit possessing a pencil mold washing implement, both the substrate washing stations that apply to this invention may constitute the upper case washing unit 10 and a lower-berth washing unit 50 at roll/roll scrubber washing unit, as shown in drawing 8.

[0042]

[Effect of the Invention]

As mentioned above, as explained, according to invention given in each claim, the effectiveness which was excellent as follows is acquired.

[0043]

Since the washing unit has been arranged to two steps of upper and lower sides, while being able to miniaturize the whole equipment according to invention according to claim 1, installation area of equipment can be made small. Moreover, each washing unit also has little migration distance of the carrier robot for conveying a substrate, and it ends to it.

[0044]

According to invention according to claim 2, since an upper case washing unit and a lower-berth washing unit are washing units which enforce the mutually different washing approach, the substrate washing station constituted small can wash a substrate through a different washing process.

[0045]

When the upper case washing unit has arranged the drive more nearly up than a substrate maintenance device according to invention according to claim 3 and the lower-berth washing unit has arranged the drive more nearly caudad than a substrate maintenance device, the substrate maintenance device of vertical both the washing unit will approach mutually, and it will be arranged, there is little migration length of a substrate, and it ends, and becomes transportable [between both / of a substrate / washing units] with a small carrier robot with the small stroke of a hand.

[0046]

Since according to invention according to claim 4 it will carry in to the washing unit of another side with a carrier robot if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot, washing which passed through the washing unit of two steps of upper and lower sides with the small substrate washing station can be performed automatically.

[0047]

According to invention according to claim 5, with the substrate washing station constituted small by making one side of a vertical stage washing unit into roll/roll scrubber washing unit, and making another side into pencil scrub washing and a spin-dry unit, after carrying out roll/roll scrubber washing, pencil scrub washing can be carried out and spin desiccation can be carried out after washing termination.

[0048]

Since according to invention according to claim 6 it will carry in to the washing unit of another side and will wash if a substrate is carried in to one washing unit of the vertical stage washing units and washing termination is carried out with a carrier robot, installation area of a washing unit can be made small, and a carrier robot's migration length can be lessened, and efficient substrate washing can be performed.

[Brief Description of the Drawings]

[Drawing 1]

It is drawing showing the whole substrate washing station configuration concerning this invention.

[Drawing 2]

It is drawing showing the upper case washing unit configuration of the substrate washing station concerning this invention.

[Drawing 3]

It is drawing showing the lower-berth washing unit configuration of the substrate washing station concerning this invention.

[Drawing 4]

It is drawing showing the configuration of the carrier robot of the substrate washing station concerning this invention.

[Drawing 5]

It is drawing showing the condition of having bounded the upper case washing unit of the substrate washing station concerning this invention.

[Drawing 6]

It is the B-B sectional view of drawing 2.

[Drawing 7]

It is the F-F sectional view of drawing 3.

[Drawing 8]

It is drawing showing the whole substrate washing station configuration concerning this invention.

[Description of Notations]

10 Upper Case Washing Unit

11 Substrate Maintenance Device

12 Drive

16 Taking-Out Inlet Port

17 Closing Motion Gate

18 Chuck Laura

22 Upper Roll Sponge

23 Bottom Roll Sponge

36 Upper Penetrant Remover Nozzle

- 37 Bottom Penetrant Remover Nozzle
- 38 Upper Case Process Cup
- 41 Penetrant Remover Drain Pan
- 50 Lower-Berth Washing Unit
- 51 Hinge
- 52 Substrate Maintenance Device
- 53 Drive
- 60 Taking-Out Inlet Port
- 61 Closing Motion Gate
- 62 Wafer Chuck Wheel
- 63 Pawl
- 64 Pawl Driving Cylinder
- 66 Lower-Berth Process Cup
- 67 Penetrant Remover Drain Pan
- 68 Pencil Sponge
- 74 Washing Arm
- 81 Upper Penetrant Remover Nozzle
- 82 Bottom Penetrant Remover Nozzle
- 83 Positioning Stopper
- 84 Effluent Duct
- 90 Carrier Robot

[Translation done.]

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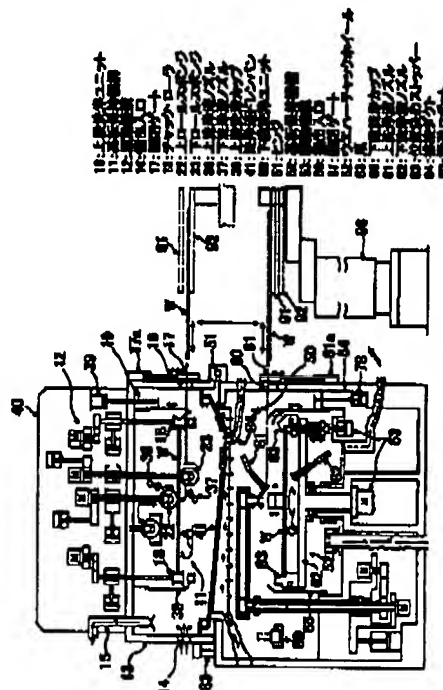
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(54) 【発明の名称】 基板洗浄装置

(57) 【要約】

【課題】 小型化が可能で設置面積が小さくてすみ、且つ部品等の交換・洗浄等のメンテナンスが容易な基板洗浄装置を提供する。

【解決手段】 上段洗浄ユニット10と下段洗浄ユニット50を上下2段に配置し、上段洗浄ユニット10は基板保持機構11、駆動機構12を具備し、下段洗浄ユニット50は基板保持機構52、駆動機構53を具備し、上段洗浄ユニット10はヒンジ51を介して上方に跳ね上げることができる。



(2)

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【特許請求の範囲】

【請求項1】 基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する洗浄ユニットを上下2段に配置したことを特徴とする基板洗浄装置。

【請求項2】 請求項1に記載の基板洗浄装置において、前記上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであることを特徴とする基板洗浄装置。

【請求項3】 請求項1に記載の基板洗浄装置において、前記上段洗浄ユニットは前記駆動機構を前記基板保持機構より上方に配置し、前記下段洗浄ユニットは前記駆動機構を前記基板保持機構より下方に配置したことを特徴とする基板洗浄装置。

【請求項4】 請求項1に記載の基板洗浄装置において、搬送ロボットを具備し、該搬送ロボットで基板を前記上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら前記搬送ロボットで他方の洗浄ユニットに搬入することを特徴とする基板洗浄装置。

【請求項5】 請求項2に記載の基板洗浄装置において、前記上下段洗浄ユニットのいずれか一方が、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール/ロールスクラブ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を前記駆動機構でスピン乾燥させるペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする基板洗浄装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は半導体ウエハ等の基板を複数の異なる洗浄工程を経て洗浄する基板洗浄装置に関するものである。

【0002】

【従来の技術】半導体デバイスの集積度の向上に伴い、基板の洗浄にも高いクリーン度が要求され、複数の異なる洗浄工程を経て洗浄されるようになってきている。従来の基板洗浄装置は、異なる洗浄工程を実施する洗浄ユニットを水平面に個々に配置し、搬送ロボットを用いて基板を洗浄ユニット間で搬送し、該複数の洗浄ユニットによる洗浄を経て洗浄し、洗浄終了後の基板を乾燥させている。

【0003】上記のように従来の洗浄装置は、複数の洗浄ユニットを水平面に配置しているため装置が大型化すると共に、大きい設置スペースを必要とするという問題がある。また、基板を搬送する搬送ロボットの移動距離が大きくなり搬送ロボットの所用面積が大きくなるという問題もあった。また、複数の洗浄ユニットが水平に配置されているため奥行きが大きくなり、部品等の交換・

洗浄等のメンテナンスを行う場合、一方の側面からアクセスすることができず複数の側面からアクセスしなければならないという問題がある。

【0004】上記のように、大きい設置スペースを必要としたり、部品等の交換・洗浄等のメンテナンスに複数の側面からアクセスしなければならないという問題は、洗浄装置を例えば床面コストが高価なクリーンルームに設置する場合に、大きなスペースを必要とするため不都合である。

【0005】

【発明が解決しようとする課題】本発明は上述の点に鑑みてなされたもので、上記問題を除去し、小型化が可能で設置面積が小さくすみ、且つ部品等の交換・洗浄等のメンテナンスが容易な基板洗浄装置を提供することを目的とする。

【0006】

【課題を解決するための手段】上記課題を解決するため請求項1に記載の発明は、基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する洗浄ユニットを上下2段に配置したことを特徴とする基板洗浄装置にある。

【0007】上記のように洗浄ユニットを上下2段に配置したので、装置全体を小型化することができるとともに、装置の設置面積を小さくすることができる。また、各洗浄ユニットに基板を搬送するための搬送ロボットの移送距離も少なくて済む。

【0008】また、請求項2に記載の発明は、請求項1に記載の基板洗浄装置において、上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであることを特徴とする。

【0009】上記のように上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであるから、小型に構成された基板洗浄装置で、異なる洗浄工程を経て基板を洗浄できる。

【0010】また、請求項2に記載の基板洗浄装置において、上下段洗浄ユニットのいずれか一方が、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール/ロールスクラブ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を前記駆動機構でスピン乾燥させるペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする。

【0011】また、上記基板洗浄装置において、上段洗浄ユニットがロール/ロールスクラブ洗浄ユニットであり、下段洗浄ユニットがペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする。

【0012】上記のように一方をロール/ロールスクラブ洗浄ユニットとし、他方をペンシルスクラブ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロール/ロールスクラブ洗浄した後、ペンシルスクラブ洗浄し、該ペンシルスクラブ洗浄

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が終了した後、スピン乾燥させることができる。

【0013】また、請求項3に記載の発明は、請求項1に記載の基板洗浄装置において、上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことを特徴とする。

【0014】上記のように上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことにより、上下両洗浄ユニットの基板保持機構が互いに接近して配置されることになり、基板の移動距離が少なく済み、ハンドのストロークが小さい小型の搬送ロボットで基板の両洗浄ユニット間の移送が可能となる。

【0015】請求項4に記載の発明は、請求項1に記載の基板洗浄装置において、搬送ロボットを具備し、該搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入することを特徴とする。

【0016】上記のように搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入するので、小型の基板洗浄装置で上下2段の洗浄ユニットを経た洗浄を自動的に行うことができる。

【0017】また、請求項1に記載の基板洗浄装置において、上段洗浄ユニットを上方に跳ね上げる跳上げ機構を具備することを特徴とする。

【0018】上記のように跳上げ機構を具備することにより、上段洗浄ユニットを上方に跳ね上げた状態で、上下段の洗浄ユニットの部品交換や洗浄等のメンテナンスが容易となる。

【0019】また、請求項5に記載の発明は、請求項2に記載の基板洗浄装置において、上下段洗浄ユニットのいずれか一方が、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール/ロールスクラブ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を駆動機構でスピン乾燥させるペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする。

【0020】また、上記基板洗浄装置において、上段洗浄ユニットがロール/ロールスクラブ洗浄ユニットであり、下段洗浄ユニットがペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする。

【0021】上記のように一方をロール/ロールスクラブ洗浄ユニットとし、他方をペンシルスクラブ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロール/ロールスクラブ洗浄した後、ペンシルスクラブ洗浄し、洗浄終了後、スピン乾燥させることができる。

【0022】

【発明の実施の形態】以下、本発明の実施の形態例を図

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面に基いて説明する。図1乃至図4は本発明に係る基板洗浄装置の構成を示す図で、図1は基板洗浄装置の全体構成、図2は基板洗浄装置の上段洗浄ユニット構成、図3は基板洗浄装置の下段洗浄ユニット構成、図4は搬送ロボットの構成をそれぞれ示す図である。図示するように、本基板洗浄装置は上下に上段洗浄ユニット10と下段洗浄ユニット50を配置し、中間に洗浄液ドレンパン41を配置して上段洗浄ユニット10と下段洗浄ユニット50を仕切って分離している。また、上段洗浄ユニット10はヒンジ51を介して図5に示すように、上方に跳ね上げ、回転移動することができるようになっている。上段洗浄ユニット10はヒンジ51を介して下げ降ろした時、下段洗浄ユニット50のケーシング54に取付けられた位置決めストッパー83で位置決めされるようになっている。

【0023】上段洗浄ユニット10は基板Wを保持する基板保持機構11と該基板保持機構11を駆動する駆動機構12を具備する。上段洗浄ユニット10の駆動機構12を除く部分はケーシング13で覆われ、該ケーシング13には吸気口14、排気ダクト15が設けられ、更に基板Wの搬入を行う搬出入口16が設けられている。また、搬出入口16にはシリンダ17aで開閉するゲート17が設けられている。また、駆動機構12はケーシング13の上に搭載され、ケーシング40で覆われている。

【0024】基板保持機構11は図6に示すように、基板Wの外周部に等間隔で配置された複数個（図では4個）のチャック・ローラ18を具備し、該チャック・ローラ18はそれぞれスピンドル19の下端に固着され、各スピンドル19は駆動機構12のモータ20で回転されるようになっている。また、各スピンドル19はシリンダ21で基板Wの径方向に移動できるようになっており、該シリンダ21の動作により複数個のチャック・ローラ18で基板Wを挟持し、モータ20の回転により、基板Wは矢印Aに示すように回転するようになっている。なお、図6は図2のB-B断面図である。

【0025】22、23はそれぞれ基板Wの上下の両面を洗浄するロール型洗浄治具にてなる上ロールスポンジ、下ロールスポンジである。上ロールスポンジ22の端部にはスピンドル24の下端に固着された傘歯車25に噛み合う傘歯車26が固着され、モータ27の回転により、矢印Dに示すように回転するようになっている。また、下ロールスポンジ23の端部にもスピンドル28の下端に固着された傘歯車29に噛み合う傘歯車30が固着され、モータ31の回転により、矢印Eに示すように回転するようになっている。

【0026】また、スピンドル24はシリンダ32により基板Wの径方向に、シリンダ33で上下方向に移動できるようになっており、これにより上ロールスポンジ22は基板Wの径方向及び上下方向に移動できる。同様に

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スピンドル28はシリンダ(図示せず)により基板Wの径方向に、シリンダ34で上下方向に移動できるようになっており、これにより下ロールスポンジ23は基板Wの径方向及び上下方向に移動できる。35は上ロールスポンジ22をセルフクリーニングするためのクリーニング槽である。また、図示は省略するが下ロールスポンジ23をセルフクリーニングするためのクリーニング槽も設けられている。

【0027】36は基板Wの上面に洗浄液を噴射するための上洗浄液ノズルであり、37は基板Wの下面に洗浄液を噴射するための下洗浄液ノズルである。基板保持機構11の外周は上段洗浄カップ38で囲まれ、該上段洗浄カップ38はシリンダ39により上下動できるようになっている。

【0028】下段洗浄ユニット50は基板Wを保持する基板保持機構52と該基板保持機構52を駆動する駆動機構53を具備する。下段洗浄ユニット50は全体がケーシング54で覆われている。該ケーシング54には吸気口55、排気口56が設けられている。ケーシング54の上部で洗浄液ドレンパン41の下面に配置されたダウンフローエアノズルダクト57は該吸気口55に連通し、排気ダクト58は排気口56に連通している。また、ケーシング54には基板Wの搬入搬出を行う搬出入口60が設けられ、該搬出入口60にはシリンダ61aで開閉するゲート61が設けられている。

【0029】基板保持機構52は図7に示すように、外周部に複数個(図では4個)の爪63を有するウエハチャックホイール62を具備する。爪63は固定爪63bと可動爪63aとからなり、固定爪63bはウエハチャックホイール62の外周部上面に固定され、可動爪63aは該固定爪63bに軸63cで回転自在に支持されている。該可動爪63aはロッド63eの一端が支軸され、常時はスプリング63dの弾発力で軸63cを中心に一方方向(爪63を閉じる方向)に付勢され、爪駆動シリンダ64を作動することにより、逆方向(爪63を開く方向)に回転するようになっている。即ち、爪駆動シリンダ64を作動し、爪63を開いた状態(可動爪63aを軸63cを中心に回転させた状態)で基板Wを固定爪63b上に載置し、爪駆動シリンダ64を不作動とすることにより、固定爪63bと可動爪63aで基板Wの外周部を挟持するようになっている。なお、図7は図3のF-F矢視図である。

【0030】ウエハチャックホイール62はモータ65で回転するようになっている。該モータ65と爪駆動シリンダ64は基板保持機構52を駆動する駆動機構53を構成する。また、ウエハチャックホイール62はその外周に配置された下段洗浄カップ66で囲まれ、該下段洗浄カップ66はシリンダ78で上下動できるようになっている。ウエハチャックホイール62の下方には洗浄ドレンパン67が配置されている。

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【0031】68は基板Wの上向面を洗浄するペンシル型洗浄治具となるペンシルスポンジであり、該ペンシルスポンジ68はスピンドル69、プリー70、ベルト71、プリー72及びスピンドル73を介してモータ86に連結され、該モータ86の回転により矢印Gに示すように回転するようになっている。プリー70、ベルト71、プリー72及びスピンドル73は洗浄アーム74内に收容されている。該洗浄アーム74はベルト77、プリー76を介してモータ75に連結され、図7の矢印Hに示すように旋回できるようになっている。また、洗浄アーム74はシリンダ79で上下動できるようになっている。

【0032】80はペンシルスポンジ68をセルフクリーニングするためのクリーニング槽である。81は基板保持機構52に保持された基板Wの上面に洗浄液を噴射する上洗浄液ノズルであり、82は該基板Wの下面に洗浄液を噴射する下洗浄液ノズルである。90は基板洗浄装置に隣接して配置した搬送ロボットであり、該搬送ロボット90は、図4に示すように、上ハンド91と下ハンド92の2本のハンドを有し、両ハンド91、92を上下方向に移動、旋回させ、それぞれのハンド91、92を水平放射状に伸縮させ位置決めできるようになっている。

【0033】上記構成の基板洗浄装置において、上段洗浄ユニット10の吸気口14から吸込まれた空気101は排気ダクト15を経て排気される。また、下段洗浄ユニット50の吸気口55から吸込まれた空気102は、ダウンフローエアノズルダクト57のノズル口57aからダウンフローとなって流出し排気ダクト58から排出される。また、上段洗浄ユニット10において、基板洗浄に用いられた洗浄液103は洗浄液ドレンパン41に流下し、排液ダクト84を通して排出される。また、下段洗浄ユニット50において、基板洗浄に用いられた洗浄液104は洗浄液ドレンパン67に流下し、排液ダクト85を通して排出される。

【0034】基板Wの洗浄に際しては、先ず搬送ロボット90の下ハンド92で洗浄の前工程から基板Wを受取る。次にシリンダ17aの動作により上段洗浄ユニット10のゲート17を上昇させ(開く)と共に、シリンダ39の動作により洗浄カップ38を上昇させる。次に搬送ロボット90は下ハンド92を搬出入口16から挿入し、保持する基板Wを基板保持機構11のチャック・ローラ18に渡し、該上ハンド92を後退させる。この状態で、シリンダ17aの動作によりゲート17を下降させる(閉じる)と共に、シリンダ39の動作により洗浄カップを下降させる。これにより基板Wを保持した基板保持機構11は周囲を上段洗浄カップ38で囲まれた状態となり、洗浄液が飛散しないようになる。上記のようにシリンダ21の動作により複数のチャック・ローラ18で基板Wを挟持し、モータ20の回転により基板Wは

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回転する。

【0035】上洗浄液ノズル36及び下洗浄液ノズル37から洗浄液を基板Wの上下面に噴射しながら、上ロールスポンジ22を基板Wの上面に下ロールスポンジ23を基板Wの下面にそれぞれ当接し、回転させて基板Wの上下面を洗浄する。洗浄終了後は、ゲート17を上昇させると共に、上段洗浄カップ38を上昇させる。搬送ロボット90はその下ハンド92を搬出入口16から内部に挿入し、洗浄終了後の基板Wを受け取り後退し、下段洗浄ユニット50の搬出入口60の位置まで下降する。次にシリンダ61aの動作によりゲート61を下降させる（開く）と共に、シリンダ78の動作により下段洗浄カップ66を下降させ、搬出入口60から下ハンド92を挿入し、その保持する基板Wを下段洗浄ユニット50の基板保持機構52に渡す。その後、上ハンド91は後退し、上昇して洗浄の前工程から基板Wを受け取り、上記と同様の動作により、上段洗浄ユニット10の基板保持機構11のチャック・ローラ18に基板Wを渡し、洗浄を行う。

【0036】下段洗浄ユニット50の基板保持機構52は、上段洗浄ユニット10で洗浄終了後の基板Wを受取った後は、爪63の固定爪63bと可動爪63aで基板Wの外周部を挟持して、基板Wを保持する。その後、下段洗浄カップ66を上昇させると共に、ゲート61を上昇させる（閉じる）。これにより基板Wを保持した基板保持機構52は下段洗浄カップ66等により囲まれた状態となり、洗浄液が飛散しないようになる。この状態でモータ65を起動し基板Wを低速領域で回転（例えば、200rpm程度以下）させる。上洗浄液ノズル81及び下洗浄液ノズル82より基板保持機構52で保持する基板Wの上下面に洗浄液を噴射すると共に、ペンシルスポンジ68を回転させながら基板Wの上面に当接し、基板Wを洗浄する。

【0037】ペンシルスポンジ68の回転はモータ86により行い、基板W上面への当接はシリンダ79により洗浄アーム74を下降させることにより行う。また、モータ75で洗浄アーム74を旋回させることにより、ペンシルスポンジ68は基板Wの上面を回転しながら旋回することになる。ペンシルスポンジ68は基板Wの回転中心を通過し、基板Wの外端まで揺動し、基板Wを洗浄する。このときペンシルスポンジ68自体、若しくは洗浄液に図示しない超音波エネルギー付与手段により超音波振動が与えられ、洗浄効果を向上させたり、洗浄液にキャビテーションを起こさせる手段によって、キャビテーション破壊作用による洗浄効果を向上させる場合もある。そして洗浄終了後は、洗浄アーム74を基板Wの外側へ旋回させ、ペンシルスポンジ68をクリーニング槽80内に挿入しセルフクリーニングする。また、基板Wの洗浄終了後は、モータ65により基板Wを高速回転

（例えば、1,000rpm～4,000rpm）さ

せ、表面に付着する洗浄液を遠心力で飛散させて乾燥、所謂スピン乾燥させる。

【0038】スピン乾燥終了後は、ゲート61を下降させる共に、下段洗浄カップ66を下降させる。この状態で、搬送ロボット90の上ハンド91を搬出入口60から下段洗浄ユニット50内に挿入し、その保持する基板Wを基板保持機構52から受取り、後退させ、該基板Wを図示しないカセットに収納する。上ハンド91の後退後は、ゲート61を上昇させると共に、下段洗浄カップ66を上昇させる。勿論、続いて上段洗浄ユニット10で洗浄の終了した基板Wを搬入する場合は、上記と同様、下ハンド92で基板Wを搬入した後、ゲート61を上昇させると共に、下段洗浄カップ66を上昇させ、洗浄・スピン乾燥を行う。

【0039】なお、上記例では上段洗浄ユニット10を2個のロール型洗浄具を具備するロール／ロールスクラバ洗浄ユニットとし、下段洗浄ユニット50をペンシル型洗浄具を具備するペンシルスクラバ洗浄・スピンドライユニットとして基板洗浄装置としたが、本発明に係る基板洗浄装置は、図8に示すように、上段洗浄ユニット10と下段洗浄ユニット50を共にロール／ロールスクラバ洗浄ユニットで構成することもある。

【0040】

【発明の効果】以上、説明したように各請求項に記載の発明によれば、下記のように優れた効果が得られる。

【0041】請求項1に記載の発明によれば、洗浄ユニットを上下2段に配置したので、装置全体を小型化することができるとともに、装置の設置面積を小さくすることができる。また、各洗浄ユニットに基板を搬送するための搬送ロボットの移送距離も少なくて済み、

【0042】請求項2に記載の発明によれば、上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであるから、小型に構成された基板洗浄装置で、異なった洗浄工程を経て基板を洗浄できる。

【0043】請求項3に記載の発明によれば、上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことにより、上下両洗浄ユニットの基板保持機構が互いに接近して配置されることになり、基板の移動距離が少なくて済み、ハンドのストロークが小さい小型の搬送ロボットで基板の両洗浄ユニット間の移送が可能となる。

【0044】請求項4に記載の発明によれば、搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入するので、小型の基板洗浄装置で上下2段の洗浄ユニットを経た洗浄を自動的に行うことができる。

【0045】請求項5に記載の発明によれば、上下段洗

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浄ユニットの一方をロール/ロールスクラバ洗浄ユニットとし、他方をペンシルスクラバ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロール/ロールスクラバ洗浄した後、ペンシルスクラバ洗浄し、洗浄終了後、スピン乾燥させることができる。

【図面の簡単な説明】

【図1】本発明に係る基板洗浄装置の全体構成を示す図である。

【図2】本発明に係る基板洗浄装置の上段洗浄ユニット 10 構成を示す図である。

【図3】本発明に係る基板洗浄装置の下段洗浄ユニット 構成を示す図である。

【図4】本発明に係る基板洗浄装置の搬送ロボットの構成を示す図である。

【図5】本発明に係る基板洗浄装置の上段洗浄ユニットを跳ね上げた状態を示す図である。

【図6】図2のB-B断面図である。

【図7】図3のF-F断面図である。

【図8】本発明に係る基板洗浄装置の全体構成を示す図 20 である。

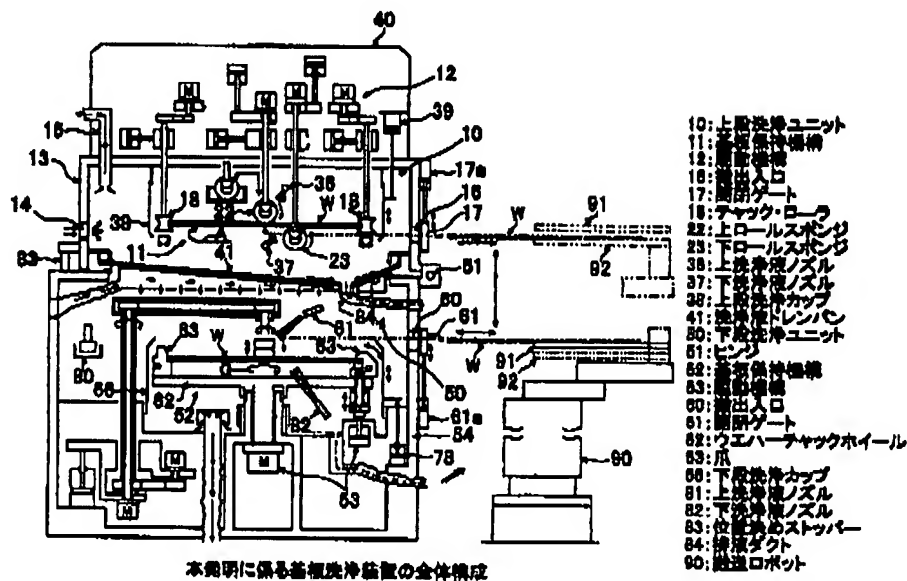
【符号の説明】

10 上段洗浄ユニット
11 基板保持機構
12 駆動機構
16 搬出入口

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開閉ゲート
チャック・ローラ
上ロールスポンジ
下ロールスポンジ
上洗浄液ノズル
下洗浄液ノズル
上段洗浄カップ
洗浄液ドレンパン
下段洗浄ユニット
ヒンジ
基板保持機構
駆動機構
搬出入口
開閉ゲート
ウエハーチャックホイール
爪
爪駆動シリンダ
下段洗浄カップ
洗浄液ドレンパン
ペンシルスポンジ
洗浄アーム
上洗浄液ノズル
下洗浄液ノズル
位置決めストッパー
排液ダクト
搬送ロボット

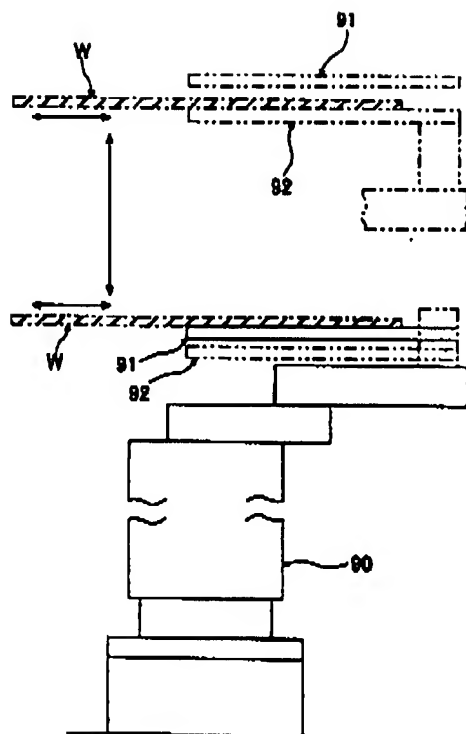
【図1】



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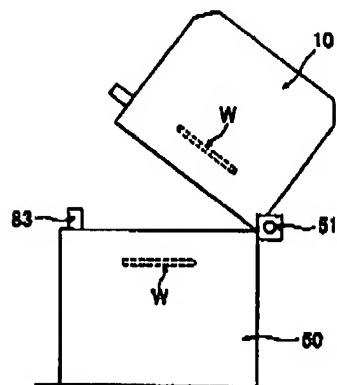
【図4】



90:搬送ロボット

本発明に係る基板洗浄装置の搬送ロボットの構成

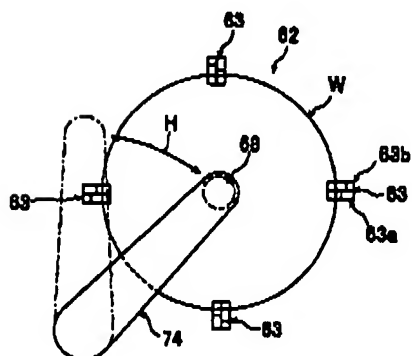
【図5】



10:上段洗浄ユニット 51:ヒンジ
50:下段洗浄ユニット 53:位置決めストッパー

本発明に係る基板洗浄装置の上段洗浄ユニットを翻ね上げた状態

【図7】



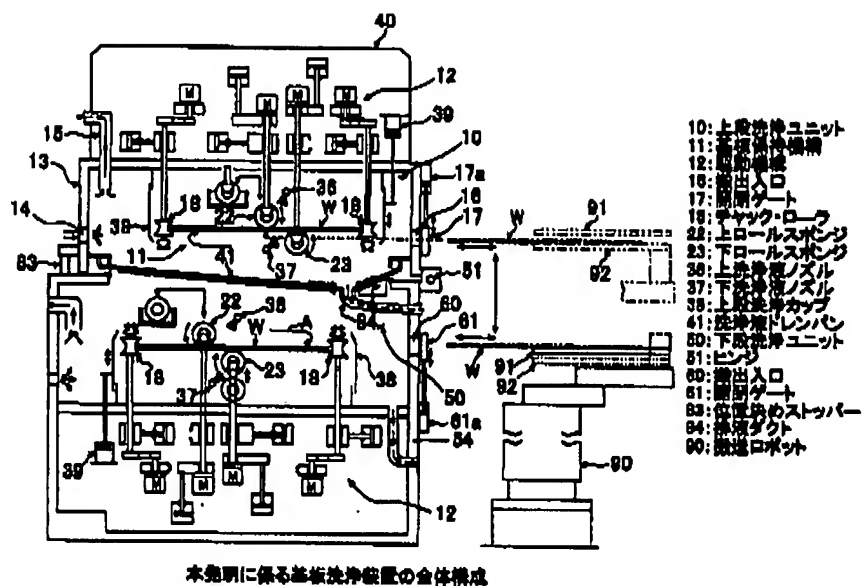
62:ウエハーチャックホイール
63:刷毛
68:ペンシルスポンジ
74:洗浄アーム

図3のF-F断面図

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【図8】



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【手続補正書】

【提出日】平成17年1月24日(2005.1.24)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】全文

【補正方法】変更

【補正の内容】

【書類名】明細書

【発明の名称】基板洗浄装置及び基板洗浄方法

【特許請求の範囲】

【請求項1】 基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する洗浄ユニットを上下2段に配置したことを特徴とする基板洗浄装置。

【請求項2】 請求項1に記載の基板洗浄装置において、
前記上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであることを特徴とする基板洗浄装置。

【請求項3】 請求項1に記載の基板洗浄装置において、
前記上段洗浄ユニットは前記駆動機構を前記基板保持機構より上方に配置し、前記下段洗浄ユニットは前記駆動機構を前記基板保持機構より下方に配置したことを特徴とする基板洗浄装置。

【請求項4】 請求項1に記載の基板洗浄装置において、
搬送ロボットを具備し、該搬送ロボットで基板を前記上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら前記搬送ロボットで他方の洗浄ユニットに搬入することを特徴とする基板洗浄装置。

【請求項5】 請求項2に記載の基板洗浄装置において、
前記上下段洗浄ユニットのいずれか一方が、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール／ロールスクラブ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を前記駆動機構でスピン乾燥させるペンシルスクラブ洗浄・スピンドライユニットであることを特徴とする基板洗浄装置。

【請求項6】 基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する上下2段に配置した洗浄ユニットのいずれか一方の洗浄ユニットに、基板を搬送ロ

ボットで基板を搬入して洗浄し、洗浄の終了した該基板を前記搬送ロボットで他方の洗浄ユニットに搬入し洗浄することを特徴とする基板洗浄方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

本発明は半導体ウエハ等の基板を複数の異なる洗浄工程を経て洗浄する基板洗浄装置及び基板洗浄方法に関するものである。

【0002】

【従来の技術】

半導体デバイスの集積度の向上に伴い、基板の洗浄にも高いクリーン度が要求され、複数の異なる洗浄工程を経て洗浄されるようになってきている。従来の基板洗浄装置は、異なる洗浄工程を実施する洗浄ユニットを水平面に個々に配置し、搬送ロボットを用いて基板を洗浄ユニット間で搬送し、該複数の洗浄ユニットによる洗浄を経て洗浄し、洗浄終了後の基板を乾燥させている。

【0003】

上記のように従来の洗浄装置は、複数の洗浄ユニットを水平面に配置しているため装置が大型化すると共に、大きい設置スペースを必要とするという問題がある。また、基板を搬送する搬送ロボットの移動距離が大きくなり搬送ロボットの所用面積が大きくなるという問題もあった。また、複数の洗浄ユニットが水平に配置されているため奥行きが大きくなり、部品等の交換・洗浄等のメンテナンスを行う場合、一方の側面からアクセスすることができず複数の側面からアクセスしなければならないという問題がある。

【0004】

上記のように、大きい設置スペースを必要としたり、部品等の交換・洗浄等のメンテナンスに複数の側面からアクセスしなければならないという問題は、洗浄装置を例えば床面コストが高価なクリーンルームに設置する場合に、大きなスペースを必要とするため不都合である。

【0005】

【発明が解決しようとする課題】

本発明は上述の点に鑑みてなされたもので、上記問題を除去し、小型化が可能で設置面積が小さくてすみ、且つ部品等の交換・洗浄等のメンテナンスが容易な基板洗浄装置及び基板洗浄方法を提供することを目的とする。

【0006】

【課題を解決するための手段】

上記課題を解決するため請求項1に記載の発明は、基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する洗浄ユニットを上下2段に配置したことを特徴とする基板洗浄装置にある。

【0007】

上記のように洗浄ユニットを上下2段に配置したので、装置全体を小型化することができるとともに、装置の設置面積を小さくすることができる。また、各洗浄ユニットに基板を搬送するための搬送ロボットの移送距離も少なくて済む。

【0008】

また、請求項2に記載の発明は、請求項1に記載の基板洗浄装置において、上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであることを特徴とする。

【0009】

上記のように上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであるから、小型に構成された基板洗浄装置で、異なった洗浄工程を経て基板を洗浄できる。

【0010】

また、請求項2に記載の基板洗浄装置において、上下段洗浄ユニットのいずれか一方が

、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール／ロールスクラバ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を前記駆動機構でスピン乾燥させるペンシルスクラバ洗浄・スピンドライユニットであることを特徴とする。

【0011】

また、上記基板洗浄装置において、上段洗浄ユニットがロール／ロールスクラバ洗浄ユニットであり、下段洗浄ユニットがペンシルスクラバ洗浄・スピンドライユニットであることを特徴とする。

【0012】

上記のように一方をロール／ロールスクラバ洗浄ユニットとし、他方をペンシルスクラバ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロール／ロールスクラバ洗浄した後、ペンシルスクラバ洗浄し、該ペンシルスクラバ洗浄が終了した後、スピン乾燥させることができる。

【0013】

また、請求項3に記載の発明は、請求項1に記載の基板洗浄装置において、上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことを特徴とする。

【0014】

上記のように上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことにより、上下両洗浄ユニットの基板保持機構が互いに接近して配置されることになり、基板の移動距離が少なく済み、ハンドのストロークが小さい小型の搬送ロボットで基板の両洗浄ユニット間の移送が可能となる。

【0015】

請求項4に記載の発明は、請求項1に記載の基板洗浄装置において、搬送ロボットを具備し、該搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入することを特徴とする。

【0016】

上記のように搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入するので、小型の基板洗浄装置で上下2段の洗浄ユニットを経た洗浄を自動的に行うことができる。

【0017】

また、請求項1に記載の基板洗浄装置において、上段洗浄ユニットを上方に跳ね上げる跳上げ機構を具備することを特徴とする。

【0018】

上記のように跳上げ機構を具備することにより、上段洗浄ユニットを上方に跳ね上げた状態で、上下段の洗浄ユニットの部品交換や洗浄等のメンテナンスが容易となる。

【0019】

また、請求項5に記載の発明は、請求項2に記載の基板洗浄装置において、上下段洗浄ユニットのいずれか一方が、基板の両面をそれぞれ洗浄する2個のロール型洗浄具を具備するロール／ロールスクラバ洗浄ユニットであり、他方がペンシル型洗浄具を具備し、洗浄した基板を駆動機構でスピン乾燥させるペンシルスクラバ洗浄・スピンドライユニットであることを特徴とする。

【0020】

また、上記基板洗浄装置において、上段洗浄ユニットがロール／ロールスクラバ洗浄ユニットであり、下段洗浄ユニットがペンシルスクラバ洗浄・スピンドライユニットであることを特徴とする。

【0021】

上記のように一方をロール／ロールスクラバ洗浄ユニットとし、他方をペンシルスクラバ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロ

ール／ロールスクラブ洗浄した後、ペンシルスクラブ洗浄し、洗浄終了後、スピン乾燥させることができる。

【0022】

また、請求項6に記載の発明は、基板を保持する基板保持機構と該基板保持機構を駆動する駆動機構を具備する上下2段に配置した洗浄ユニットのいずれか一方の洗浄ユニットに、基板を搬送ロボットで基板を搬入して洗浄し、洗浄の終了した該基板を前記搬送ロボットで他方の洗浄ユニットに搬入し洗浄することを特徴とする基板洗浄方法にある。

【0023】

上記のように搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら他方の洗浄ユニットに搬入して洗浄するので、洗浄ユニットの設置面積を小さくでき、且つ搬送ロボットの移動距離を少なくでき、効率良い基板洗浄ができる。

【0024】

【発明の実施の形態】

以下、本発明の実施の形態例を図面に基いて説明する。図1乃至図4は本発明に係る基板洗浄装置の構成を示す図で、図1は基板洗浄装置の全体構成、図2は基板洗浄装置の上段洗浄ユニット構成、図3は基板洗浄装置の下段洗浄ユニット構成、図4は搬送ロボットの構成をそれぞれ示す図である。図示するように、本基板洗浄装置は上下に上段洗浄ユニット10と下段洗浄ユニット50を配置し、中間に洗浄液ドレンパン41を配置して上段洗浄ユニット10と下段洗浄ユニット50を仕切って分離している。また、上段洗浄ユニット10はヒンジ51を介して図5に示すように、上方に跳ね上げ、回転移動することができるようになっている。上段洗浄ユニット10はヒンジ51を介して下げ降ろした時、下段洗浄ユニット50のケーシング54に取り付けられた位置決めストッパー83で位置決めされるようになっている。

【0025】

上段洗浄ユニット10は基板Wを保持する基板保持機構11と該基板保持機構11を駆動する駆動機構12を具備する。上段洗浄ユニット10の駆動機構12を除く部分はケーシング13で覆われ、該ケーシング13には吸気口14、排気ダクト15が設けられ、更に基板Wの搬入搬出を行う搬出入口16が設けられている。また、搬出入口16にはシリンダ17aで開閉するゲート17が設けられている。また、駆動機構12はケーシング13の上に搭載され、ケーシング40で覆われている。

【0026】

基板保持機構11は図6に示すように、基板Wの外周部に等間隔で配置された複数個（図では4個）のチャック・ローラ18を具備し、該チャック・ローラ18はそれぞれスピンドル19の下端に固着され、各スピンドル19は駆動機構12のモータ20で回転されるようになっている。また、各スピンドル19はシリンダ21で基板Wの径方向に移動できるようになっており、該シリンダ21の動作により複数個のチャック・ローラ18で基板Wを挟持し、モータ20の回転により、基板Wは矢印Aに示すように回転するようになっている。なお、図6は図2のB-B断面図である。

【0027】

22、23はそれぞれ基板Wの上下の両面を洗浄するロール型洗浄治具にてなる上ロールスポンジ、下ロールスポンジである。上ロールスポンジ22の端部にはスピンドル24の下端に固着された傘歯車25に噛み合う傘歯車26が固着され、モータ27の回転により、矢印Dに示すように回転するようになっている。また、下ロールスポンジ23の端部にもスピンドル28の下端に固着された傘歯車29に噛み合う傘歯車30が固着され、モータ31の回転により、矢印Eに示すように回転するようになっている。

【0028】

また、スピンドル24はシリンダ32により基板Wの径方向に、シリンダ33で上下方向に移動できるようになっており、これにより上ロールスポンジ22は基板Wの径方向及び上下方向に移動できる。同様にスピンドル28はシリンダ（図示せず）により基板Wの

径方向に、シリンダ34で上下方向に移動できるようになっており、これにより下ロールスポンジ23は基板Wの径方向及び上下方向に移動できる。35は上ロールスポンジ22をセルフクリーニングするためのクリーニング槽である。また、図示は省略するが下ロールスポンジ23をセルフクリーニングするためのクリーニング槽も設けられている。

【0029】

36は基板Wの上面に洗浄液を噴射するための上洗浄液ノズルであり、37は基板Wの下面に洗浄液を噴射するための下洗浄液ノズルである。基板保持機構11の外周は上段洗浄カップ38で囲まれ、該上段洗浄カップ38はシリンダ39により上下動できるようになっている。

【0030】

下段洗浄ユニット50は基板Wを保持する基板保持機構52と該基板保持機構52を駆動する駆動機構53を具備する。下段洗浄ユニット50は全体がケーシング54で覆われている。該ケーシング54には吸気口55、排気口56が設けられている。ケーシング54の上部で洗浄液ドレンパン41の下面に配置されたダウフローエアーノズルダクト57は該吸気口55に連通し、排気ダクト58は排気口56に連通している。また、ケーシング54には基板Wの搬入搬出を行う搬出入口60が設けられ、該搬出入口60にはシリンダ61aで開閉するゲート61が設けられている。

【0031】

基板保持機構52は図7に示すように、外周部に複数個（図では4個）の爪63を有するウエハーチャックホイール62を具備する。爪63は固定爪63bと可動爪63aとからなり、固定爪63bはウエハーチャックホイール62の外周部上面に固定され、可動爪63aは該固定爪63bに軸63cで回転自在に支持されている。該可動爪63aはロッド63eの一端が支軸され、常時はスプリング63dの弾発力で軸63cを中心に一方方向（爪63を閉じる方向）に付勢され、爪駆動シリンダ64を作動することにより、逆方向（爪63を開く方向）に回転するようになっている。即ち、爪駆動シリンダ64を作動し、爪63を開いた状態（可動爪63aを軸63cを中心に回転させた状態）で基板Wを固定爪63b上に載置し、爪駆動シリンダ64を不作動とすることにより、固定爪63bと可動爪63aで基板Wの外周部を挟持するようになっている。なお、図7は図3のF-F矢視図である。

【0032】

ウエハーチャックホイール62はモータ65で回転するようになっている。該モータ65と爪駆動シリンダ64は基板保持機構52を駆動する駆動機構53を構成する。また、ウエハーチャックホイール62はその外周に配置された下段洗浄カップ66で囲まれ、該下段洗浄カップ66はシリンダ78で上下動できるようになっている。ウエハーチャックホイール62の下方には洗浄ドレンパン67が配置されている。

【0033】

68は基板Wの上両面を洗浄するペンシル型洗浄治具となるペンシルスポンジであり、該ペンシルスポンジ68はスピンドル69、ブリー70、ベルト71、ブリー72及びスピンドル73を介してモータ86に連結され、該モータ86の回転により矢印Gに示すように回転するようになっている。ブリー70、ベルト71、ブリー72及びスピンドル73は洗浄アーム74内に収容されている。該洗浄アーム74はベルト77、ブリー76を介してモータ75に連結され、図7の矢印Hに示すように旋回できるようになっている。また、洗浄アーム74はシリンダ79で上下動できるようになっている。

【0034】

80はペンシルスポンジ68をセルフクリーニングするためのクリーニング槽である。81は基板保持機構52に保持された基板Wの上面に洗浄液を噴射する上洗浄液ノズルであり、82は該基板Wの下面に洗浄液を噴射する下洗浄液ノズルである。90は基板洗浄装置に隣接して配置した搬送ロボットであり、該搬送ロボット90は、図4に示すように、上ハンド91と下ハンド92の2本のハンドを有し、両ハンド91、92を上下方向に移動、旋回させ、それぞれのハンド91、92を水平放射状に伸縮させ位置決めできるよ

うになっている。

【0035】

上記構成の基板洗浄装置において、上段洗浄ユニット10の吸気口14から吸込まれた空気101は排気ダクト15を経て排気される。また、下段洗浄ユニット50の吸気口55から吸込まれた空気102は、ダウンフローエアーノズルダクト57のノズル口57aからダウンフローとなって流出し排気ダクト58から排出される。また、上段洗浄ユニット10において、基板洗浄に用いられた洗浄液103は洗浄液ドレンパン41に流下し、排液ダクト84を通して排出される。また、下段洗浄ユニット50において、基板洗浄に用いられた洗浄液104は洗浄液ドレンパン67に流下し、排液ダクト85を通して排出される。

【0036】

基板Wの洗浄に際しては、先ず搬送ロボット90の下ハンド92で洗浄の前工程から基板Wを受取る。次にシリンダ17aの動作により上段洗浄ユニット10のゲート17を上昇させ（開く）と共に、シリンダ39の動作により洗浄カップ38を上昇させる。次に搬送ロボット90は下ハンド92を搬出入口16から挿入し、保持する基板Wを基板保持機構11のチャック・ローラ18に渡し、該上ハンド92を後退させる。この状態で、シリンダ17aの動作によりゲート17を下降させる（閉じる）と共に、シリンダ39の動作により洗浄カップを下降させる。これにより基板Wを保持した基板保持機構11は周囲を上段洗浄カップ38で囲まれた状態となり、洗浄液が飛散しないようになる。上記のようにシリンダ21の動作により複数のチャック・ローラ18で基板Wを挟持し、モータ20の回転により基板Wは回転する。

【0037】

上洗浄液ノズル36及び下洗浄液ノズル37から洗浄液を基板Wの上下面に噴射しながら、上ロールスポンジ22を基板Wの上面に下ロールスポンジ23を基板Wの下面にそれぞれ当接し、回転させて基板Wの上下面を洗浄する。洗浄終了後は、ゲート17を上昇させると共に、上段洗浄カップ38を上昇させる。搬送ロボット90はその下ハンド92を搬出入口16から内部に挿入し、洗浄終了後の基板Wを受け取り後退し、下段洗浄ユニット50の搬出入口60の位置まで下降する。次にシリンダ61aの動作によりゲート61を下降させる（開く）と共に、シリンダ78の動作により下段洗浄カップ66を下降させ、搬出入口60から下ハンド92を挿入し、その保持する基板Wを下段洗浄ユニット50の基板保持機構52に渡す。その後、上ハンド91は後退し、上昇して洗浄の前工程から基板Wを受取り、上記と同様の動作により、上段洗浄ユニット10の基板保持機構11のチャック・ローラ18に基板Wを渡し、洗浄を行う。

【0038】

下段洗浄ユニット50の基板保持機構52は、上段洗浄ユニット10で洗浄終了後の基板Wを受取った後は、爪63の固定爪63bと可動爪63aで基板Wの外周部を挟持して、基板Wを保持する。その後、下段洗浄カップ66を上昇させると共に、ゲート61を上昇させる（閉じる）。これにより基板Wを保持した基板保持機構52は下段洗浄カップ66等により囲まれた状態となり、洗浄液が飛散しないようになる。この状態でモータ65を起動し基板Wを低速領域で回転（例えば、200rpm程度以下）させる。上洗浄液ノズル81及び下洗浄液ノズル82より基板保持機構52で保持する基板Wの上下面に洗浄液を噴射すると共に、ペンシルスポンジ68を回転させながら基板Wの上面に当接し、基板Wを洗浄する。

【0039】

ペンシルスポンジ68の回転はモータ86により行い、基板W上面への当接はシリンダ79により洗浄アーム74を下降させることにより行う。また、モータ75で洗浄アーム74を旋回させることにより、ペンシルスポンジ68は基板Wの上面を回転しながら旋回することになる。ペンシルスポンジ68は基板Wの回転中心を通過し、基板Wの外端まで揺動し、基板Wを洗浄する。このときペンシルスポンジ68自体、若しくは洗浄液に図示しない超音波エネルギー付与手段により超音波振動が与えられ、洗浄効果を向上させたり

、洗浄液にキャビテーションを起こさせる手段によって、キャビテーション破壊作用による洗浄効果を向上させる場合もある。そして洗浄終了後は、洗浄アーム74を基板Wの外側へ旋回させ、ペンシルスポンジ68をクリーニング槽80内に挿入しセルフクリーニングする。また、基板Wの洗浄終了後は、モータ65により基板Wを高速回転（例えば、1,000rpm～4,000rpm）させ、表面に付着する洗浄液を遠心力で飛散させて乾燥、所謂スピン乾燥させる。

【0040】

スピン乾燥終了後は、ゲート61を下降させる共に、下段洗浄カップ66を下降させる。この状態で、搬送ロボット90の上ハンド91を搬送出入口60から下段洗浄ユニット50内に挿入し、その保持する基板Wを基板保持機構52から受取り、後退させ、該基板Wを図示しないカセットに収納する。上ハンド91の後退後は、ゲート61を上昇させると共に、下段洗浄カップ66を上昇させる。勿論、続いて上段洗浄ユニット10で洗浄の終了した基板Wを搬入する場合は、上記と同様、下ハンド92で基板Wを搬入した後、ゲート61を上昇させると共に、下段洗浄カップ66を上昇させ、洗浄・スピン乾燥を行う。

【0041】

なお、上記例では上段洗浄ユニット10を2個のロール型洗浄具を具備するロール／ロールスクラバ洗浄ユニットとし、下段洗浄ユニット50をペンシル型洗浄具を具備するペンシルスクラバ洗浄・スピンドライユニットとして基板洗浄装置としたが、本発明に係る基板洗浄装置は、図8に示すように、上段洗浄ユニット10と下段洗浄ユニット50を共にロール／ロールスクラバ洗浄ユニットで構成することもある。

【0042】

【発明の効果】

以上、説明したように各請求項に記載の発明によれば、下記のように優れた効果が得られる。

【0043】

請求項1に記載の発明によれば、洗浄ユニットを上下2段に配置したので、装置全体を小型化することができるとともに、装置の設置面積を小さくすることができる。また、各洗浄ユニットに基板を搬送するための搬送ロボットの移送距離も少なく済む。

【0044】

請求項2に記載の発明によれば、上段洗浄ユニットと下段洗浄ユニットが互いに異なった洗浄方法を実施する洗浄ユニットであるから、小型に構成された基板洗浄装置で、異なった洗浄工程を経て基板を洗浄できる。

【0045】

請求項3に記載の発明によれば、上段洗浄ユニットは駆動機構を基板保持機構より上方に配置し、下段洗浄ユニットは駆動機構を基板保持機構より下方に配置したことにより、上下両洗浄ユニットの基板保持機構が互いに接近して配置されることになり、基板の移動距離が少なく済み、ハンドのストロークが小さい小型の搬送ロボットで基板の両洗浄ユニット間の移送が可能となる。

【0046】

請求項4に記載の発明によれば、搬送ロボットで基板を上下段洗浄ユニットのいずれか一方の洗浄ユニットに搬入し、洗浄終了したら搬送ロボットで他方の洗浄ユニットに搬入するので、小型の基板洗浄装置で上下2段の洗浄ユニットを経た洗浄を自動的に行うことができる。

【0047】

請求項5に記載の発明によれば、上下段洗浄ユニットの一方をロール／ロールスクラバ洗浄ユニットとし、他方をペンシルスクラバ洗浄・スピンドライユニットとすることにより、小型に構成された基板洗浄装置で、ロール／ロールスクラバ洗浄した後、ペンシルスクラバ洗浄し、洗浄終了後、スピン乾燥させることができる。

【0048】

請求項6に記載の発明によれば、搬送ロボットで基板を上下段洗浄ユニットのいずれか

一方の洗浄ユニットに搬入し、洗浄終了したら他方の洗浄ユニットに搬入して洗浄するので、洗浄ユニットの設置面積を小さくでき、且つ搬送ロボットの移動距離を少なくでき、効率良い基板洗浄ができる。

【図面の簡単な説明】

【図 1】

本発明に係る基板洗浄装置の全体構成を示す図である。

【図 2】

本発明に係る基板洗浄装置の上段洗浄ユニット構成を示す図である。

【図 3】

本発明に係る基板洗浄装置の下段洗浄ユニット構成を示す図である。

【図 4】

本発明に係る基板洗浄装置の搬送ロボットの構成を示す図である。

【図 5】

本発明に係る基板洗浄装置の上段洗浄ユニットを跳ね上げた状態を示す図である。

【図 6】

図 2 の B - B 断面図である。

【図 7】

図 3 の F - F 断面図である。

【図 8】

本発明に係る基板洗浄装置の全体構成を示す図である。

【符号の説明】

1 0	上段洗浄ユニット
1 1	基板保持機構
1 2	駆動機構
1 6	搬出入口
1 7	開閉ゲート
1 8	チャック・ローラ
2 2	上ロールスポンジ
2 3	下ロールスポンジ
3 6	上洗浄液ノズル
3 7	下洗浄液ノズル
3 8	上段洗浄カップ
4 1	洗浄液ドレンパン
5 0	下段洗浄ユニット
5 1	ヒンジ
5 2	基板保持機構
5 3	駆動機構
6 0	搬出入口
6 1	開閉ゲート
6 2	ウエハーチャックホイール
6 3	爪
6 4	爪駆動シリンダ
6 6	下段洗浄カップ
6 7	洗浄液ドレンパン
6 8	ペンシルスポンジ
7 4	洗浄アーム
8 1	上洗浄液ノズル
8 2	下洗浄液ノズル
8 3	位置決めストッパー
8 4	排液ダクト

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